1.0
4.5
2.8
2.5
3.2
2.2
3.6
1.1
4.0
2.0
1.8
1.25
1.4
1.6

Ontario

Ontario Geological Survey
Open File Report 6119

Regional Modern Alluvium Sampling Survey of the Cobalt–Elk Lake Area, Northeastern Ontario

2004

104-02772/

Ontario

ONTARIO GEOLOGICAL SURVEY

Open File Report 6119

Regional Modern Alluvium Sampling Survey of the Cobalt-Elk Lake Area, Northeastern Ontario

by

J.L. Reid

2004

Parts of this publication may be quoted if credit is given. It is recommended that reference to this publication be made in the following form:

Reid, J.L. 2004. Regional modern alluvium sampling survey of the Cobalt-Elk Lake area, northeastern Ontario; Ontario Geological Survey, Open File Report 6119, 140p.

© Queen's Printer for Ontario, 2004

© Queen's Printer for Ontario, 2004.

Open File Reports of the Ontario Geological Survey are available for viewing at the Mines Library in Sudbury, at the Mines and Minerals Information Centre in Toronto, and at the regional Mines and Minerals office whose district includes the area covered by the report (see below).

Copies can be purchased at Publication Sales and the office whose district includes the area covered by the report. Although a particular report may not be in stock at locations other than the Publication Sales office in Sudbury, they can generally be obtained within 3 working days. All telephone, fax, mail and e-mail orders should be directed to the Publication Sales office in Sudbury. Use of VISA or MasterCard ensures the fastest possible service. Cheques or money orders should be made payable to the *Minister of Finance.*

Mines and Minerals Information Centre (MMIC) Tel: (416) 314-3800
Macdonald Block, Room M2-17
900 Bay St.
Toronto, Ontario M7A 1C3

Mines Library Tel: (705) 670-5615
933 Ramsey Lake Road, Level A3
Sudbury, Ontario P3E 6B5

Publication Sales Tel: (705) 670-5691(local)
933 Ramsey Lake Rd., Level A3 1-888-415-9845(toll-free)
Sudbury, Ontario P3E 6B5 Fax: (705) 670-5770
E-mail: pubsales@ndm.gov.on.ca

Regional Mines and Minerals Offices:

Kenora - Suite 104, 810 Robertson St., Kenora P9N 4J2

Kirkland Lake - 10 Government Rd. E., Kirkland Lake P2N 1A8

Red Lake - Box 324, Ontario Government Building, Red Lake P0V 2M0

Sault Ste. Marie - 70 Foster Dr., Ste. 200, Sault Ste. Marie P6A 6V8

Southern Ontario - P.O. Bag Service 43, 126 Old Troy Rd., Tweed K0K 3J0

Sudbury - Level B3, 933 Ramsey Lake Rd., Sudbury P3E 6B5

Thunder Bay - Suite B002, 435 James St. S., Thunder Bay P7E 6S7

Timmins - Ontario Government Complex, P.O. Bag 3060, Hwy. 101 East, South Porcupine P0N 1H0

Toronto - MMIC, Macdonald Block, Room M2-17, 900 Bay St., Toronto M7A 1C3

This report has not received a technical edit. Discrepancies may occur for which the Ontario Ministry of Northern Development and Mines does not assume any liability. Source references are included in the report and users are urged to verify critical information. Recommendations and statements of opinions expressed are those of the author or authors and are not to be construed as statements of government policy.

If you wish to reproduce any of the text, tables or illustrations in this report, please write for permission to the Team Leader, Publication Services, Ministry of Northern Development and Mines, 933 Ramsey Lake Road, Level B4, Sudbury, Ontario P3E 6B5.

Cette publication est disponible en anglais seulement.

Parts of this report may be quoted if credit is given. It is recommended that reference be made in the following form:

Reid, J.L. 2004. Regional modern alluvium sampling survey of the Cobalt-Elk Lake area, northeastern Ontario; Ontario Geological Survey, Open File Report 6119, 140p.

Contents

Abstract xiii

Introduction 1

Study Area 1
  Location 1
  Physiography 3

Bedrock Geology 3

Quaternary Geology 5

Sampling Methodology 7

Pebble Lithology 8

Heavy Mineral Recovery and Identification 9

Estimation of Grain Numbers and Data Normalization 9

Geochemical Analysis, Results and Interpretation 11
  Kimberlite Indicator Minerals 11
    Garnet 11
    Chromites 20
    Chrome Diopside 22
    Ilmenite 28
    Olivine 32
  Total Kimberlite Indicator Minerals and Recommendations for Kimberlite Exploration 34
  Metamorphic/Magmatic Massive Sulphide Indicator Minerals 40
    Chrome Diopside 40
    Chromite 42
  Other Metamorphic/Magmatic Massive Sulphide Indicator Minerals 42
  Gold 44

Pebble Data 45

Conclusions 47
  Kimberlites and Related Rocks 47
  Base Metal and Gold 47

Acknowledgments 47

References 47

Appendix A. Sample Site Locations 51

Appendix C. Summary of Kimberlite Indicator Mineral Counts 54

Appendix E. Summary of Microprobe Data for Indicator Minerals 61

Appendix I. Metamorphic/Magmatic Massive Sulphide Indicator Mineral Data Picking Results 118

Appendix J. Pebble Lithology Counts 134

Appendix K. Summary of Normalized Kimberlite Indicator Mineral Results 137

Metric Conversion Table 140

FIGURES

1. Location of 2002 study area (striped) and known kimberlites in relation to other KIM survey areas......... 2
2. Location and general bedrock geology of the study area 4
3. Generalized Quaternary geology of the study area........ 6
4. Sample site location map........ back pocket
5. Photograph of sample site illustrating boulder traps. Alluvial gravel collects on the downstream side of the boulder making it ideal for sampling........ 8
6. Heavy mineral concentrate process flow chart........ 10
7. CaO versus Cr_2O_3 plot of G9 and G10 garnets recovered from the study area 12
8. J-factor classification of all G9 and G10 garnets........ 13
9. Cr_2O_3–TiO_2 plot showing lherzolitic garnets and chromium-poor megacrysts from the study area 14
10. FeO–TiO_2 plot showing eclogitic and crustal garnets from the study area........ 14
11. Na_2O–TiO_2 plot showing Group I and II eclogitic garnets and chromium-poor megacrystic garnets from the study area........ 15
12. Na_2O–CaO plot of garnets from the study area and the megacrystic field 15
13. Regional distribution of G10 garnet grains. 16
14. Regional distribution of G9 garnet grains. 17
15. Regional distribution of Group II eclogitic garnet grains........ 18
16. Regional distribution of chromium-poor megacrystic garnet grains. 19
17. MgO–Cr_2O_3 plot of all chromite grains recovered from the study area 20
18. TiO_2–Cr_2O_3 plot of all chromite grains recovered from the study area 21
19. Regional distribution of diamond inclusion and intergrowth field chromite grains. 23
20. Regional distribution of chromite KIM grains. 24
21. Regional distribution of possible chromite KIM grains (includes overlap field chromites)........ 25
22. Ternary plot of Cr_2O_3–Al_2O_3–Na_2O showing all Cr-diopside grains from the survey area........ 26
23. Regional distribution of Cr-diopside KIM grains that fall within the field shown on Figure 22........ 27
24. Ca/(Ca+Mg) versus Na_2O classification scheme for clinopyroxenes from the study area that plot within the field defined by mantle xenoliths and xenocrysts on the Al_2O_3–Na_2O–Cr_2O_3 ternary diagram (*see* Figure 22). 28
25. Regional distribution of Cr-diopside KIM grains based on the Ca/(Ca+Mg)–Na_2O plot (*see* Figure 24)... 29
26. MgO–Cr_2O_3 plot of kimberlite ilmenites (>4 weight % MgO) from the survey area........ 30
27. Regional distribution of ilmenite KIM grains. 31
28. MgO number (MgO#) versus SiO_2 plot showing compositions of olivines recovered from the survey area. 32
29. Regional distribution of olivine KIM grains according to MgO number (MgO#) versus SiO_2 plot (*see* Figure 28). 33
30. Forsterite content (Fo#) versus CaO plot for olivines recovered from the survey area. 34
31. Regional distribution of olivine KIM grains according to forsterite content (Fo#) versus CaO plot (*see* Figure 30). 35

32. Regional distribution of diamond potential KIM grains (G10 garnet and diamond inclusion chromite grains)........ 36
33. Regional distribution of total KIM grains (all garnets, chromite KIMs, ilmenite KIMS, Cr-diopside KIMs and olivine KIMs). 38
34. Regional distribution of total possible KIM grains (includes total KIMs as well as overlap field chromites)........ 39
35. Regional distribution of MMSIM® indicators. 43
36. Regional distribution of gold grains. 46

TABLES

1. List of indicator minerals found in the survey area and the associated base metal mineralization style 41
2. Summary of MMSIMs picked and anomalous MMSIM sites 42
3. Summary of gold grain sites........ 45

Miscellaneous Release—Data 124

Modern Alluvium Data Release, Cobalt–Elk Lake Area, Northeastern Ontario; by J.L. Reid

This release consists of data resulting from heavy mineral processing of 183 samples collected over an area of approximately 2850 km^2 in the Cobalt–Elk Lake area, northeastern Ontario. The data consist of kimberlite indicator minerals (KIMs), metamorphic/magmatic massive sulphide indicator minerals (MMSIM®[1]) and gold grains recovered from modern alluvium, till and glaciofluvial sand and gravel samples. The data are being released in conjunction with Open File Report 6119. Files in this release contain information on sample site locations; abbreviations used; sample processing data; KIMs picked and picking remarks; microprobe analyses of KIMs; gold grain data; MMSIMs® picked, picking remarks and assemblages present; pebble lithology data; and normalized KIM results. Data are available as compressed files in ASCII (*.txt*) and Microsoft Excel (*.xls*) file format on one CD-ROM.

This CD-ROM is available separately from the report.

---

[1] MMSIM is a registered trademark of Overburden Drilling Management Limited, Nepean, Ontario

Abstract

In July and August, 2002, the Ontario Geological Survey (OGS) completed a regional modern alluvium sampling survey in the New Liskeard–Elk Lake area of northeastern Ontario. The primary objective of this survey was to determine the presence of kimberlite indicator minerals (KIMs), metamorphic/magmatic massive sulphide indicator minerals (MMSIM®[1]) and gold grains. The survey area covered approximately 2850 km^2. A total of 175 modern alluvium, 2 till and 6 glaciofluvial sand and gravel samples were collected.

A number of important indicator minerals were recovered as part of this survey, including G10 Cr-pyrope garnets (3); G9 Cr-pyrope garnets (94); megacrystic garnets (35); eclogitic garnets (20); picro-ilmenites; kimberlitic Cr-diopsides and chromites; and forsteritic olivines. Locations of interest are highlighted in the report including 1) the southeastern part of the survey area, in and around Cobalt and New Liskeard; and 2) the northwestern edge of the survey area where numerous possible chromite KIMs were found.

Gold grains were recovered at 76 sites. Most of the grains recovered were reshaped, suggesting some distance of transport from source. The most notable cluster of anomalous gold grain sites occurs as a grouping along the Montreal River near the town of Elk Lake.

A number of metamorphic/magmatic massive sulphide indicator minerals were also recovered. Areas that exhibit anomalous distributions of MMSIM® are highlighted in the report.

Digital data are available separately as Miscellaneous Release—Data (MRD) 124.

---

[1] MMSIM is a registered trademark of Overburden Drilling Management Limited, Nepean, Ontario

Regional Modern Alluvium Sampling Survey of the Cobalt–Elk Lake Area, Northeastern Ontario

J.L. Reid[1]
Ontario Geological Survey
Open File Report 6119
2004

---

[1] Sedimentary Geoscience Section, Ontario Geological Survey
Sudbury, Ontario

Introduction

In recent years, the discovery of kimberlites in northeastern Ontario near New Liskeard and Kirkland Lake has triggered an increase in diamond exploration across the region. In these areas, the thickness of glacial sediments ranges from nil to greater than 100 m. Kimberlite, being relatively soft, has been differentially eroded by preglacial weathering and glacial erosion such that it subcrops 3 to 35 m below the surrounding bedrock (McClenaghan et al. 1999a). Because of this deep erosion, all kimberlite pipes in the area are covered by glacial sediments and have no surface expression. Through indicator mineral and geophysical surveys, several kimberlite pipes and dikes have been discovered in the region within the last 15 years (McClenaghan et al. 1999b).

To further evaluate the diamond and other mineral potential of this region of northeastern Ontario, the Ontario Geological Survey completed a modern alluvium survey in the Temagami–Marten River area during the summer of 2000 (Allan 2001) and another along the Mattawa–Cobalt Corridor during the summer of 2001 (Figure 1; Reid 2002). Further work was completed in the Kirkland Lake–Matachewan area during the summer of 2003. The results of that work will be released at a later date. The current study, covering the Cobalt–Elk Lake area, is a northern extension of the survey completed in 2001 (*see* Figure 1). The primary objective of the current study is to extend the regional information base concerning the types and distribution of kimberlite indicator minerals (KIM) found in modern alluvium northwestward to the Elk Lake area.

Diamond exploration remains very active throughout northeastern Ontario. Over 22 000 new claim units have been recorded, to date, within the Temagami–Marten River survey area since the release of the Temagami–Marten River indicator mineral report in April 2001. Since the release of the Mattawa–Cobalt corridor indicator mineral report in June 2002, almost 3000 new claim units have been recorded in that area alone (V. Felix, OGS, personal communication, 2003).

Kimberlite is a rock type commonly recognized as the primary host for diamond. The suite of kimberlite indicator minerals is known to include pyrope and eclogitic garnets, magnesium ilmenite, chromite, chrome diopside, forsteritic olivine and diamond. The presence of these indicator minerals in collected samples is be used to determine the prospect for and proximity of any diamond-bearing kimberlites in the area. As well, heavy mineral assemblages are examined for gold grains and metamorphic/magmatic massive sulphide indicator minerals (MMSIM®[1])

Study Area

LOCATION

The Cobalt–Elk Lake study area is represented on 10, 1:50 000 scale National Topographic System (NTS) map sheets. The northwest part of the study area is covered by the southwest corner of the Charlton sheet (41 P/16), the east half of the Gowganda sheet (41P/10), the southeast corner of the Matachewan sheet (41P/15), the north corner of the Smoothwater Lake sheet (41 P/7) and the entire Elk Lake sheet (41 P/9). The southeast part of the study area is covered by the west half of the Cobalt sheet (31 M/5), the east half of the Lady Evelyn Lake sheet (41 P/8), the northeast corner of the Obabika Lake sheet (41 P/1), the northwest corner of the Temagami sheet (31 M/4) and the southwest corner of the New Liskeard sheet (31 M/12).

---

[1] MMSIM is a registered trademark of Overburden Drilling Management Limited, Nepean, Ontario

A network of primary and secondary roads and trails provided reasonable access to the study area. The presence of numerous lakes and rivers provided boat access to otherwise remote locations. The larger lakes allowed for float plane access and very remote sites were accessed by helicopter.

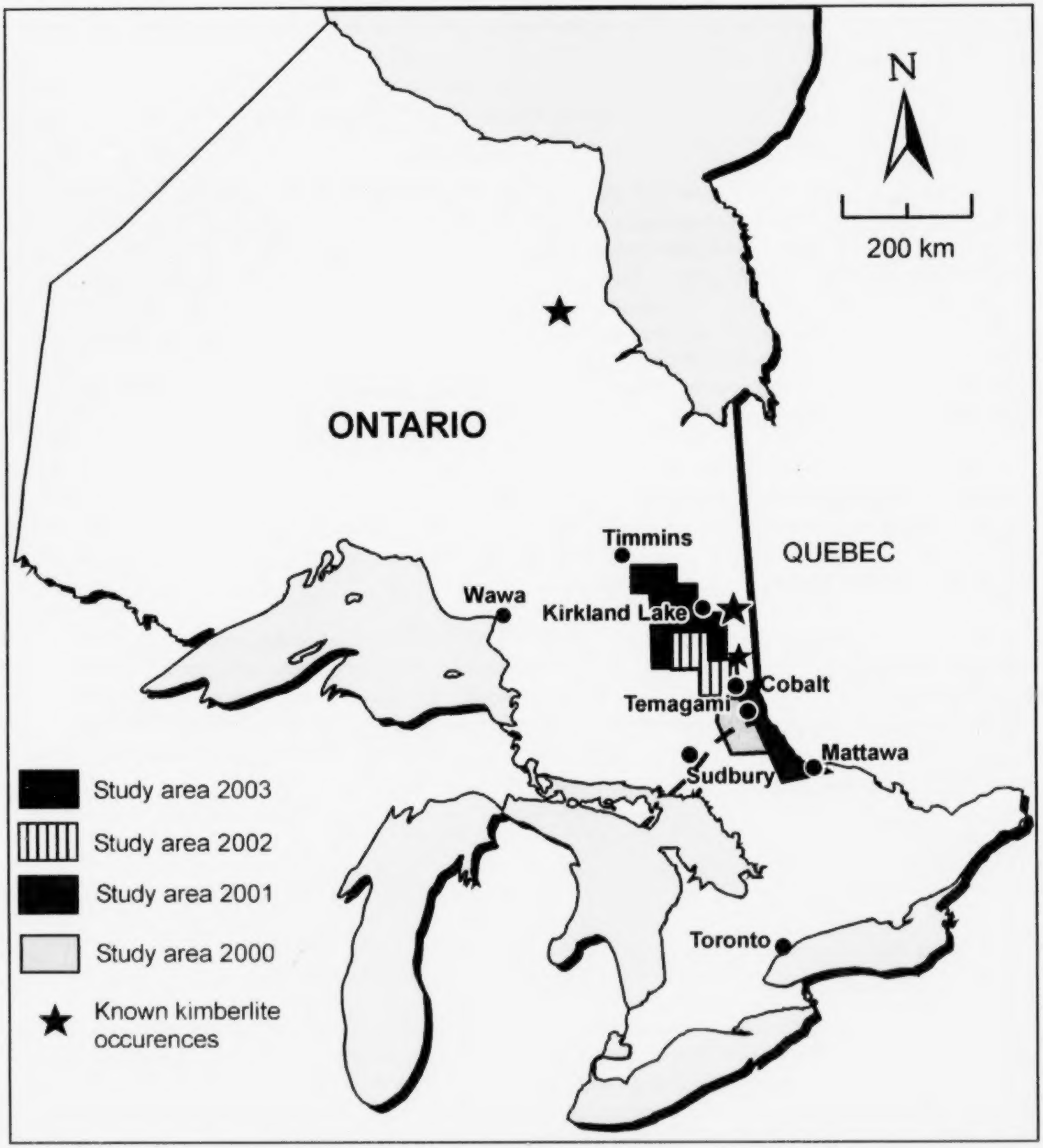
N
200 km
ONTARIO
QUEBEC
Timmins
Wawa
Kirkland Lake
Cobalt
Temagami
Mattawa
Sudbury
Toronto
Study area 2003
Study area 2002
Study area 2001
Study area 2000
Known kimberlite occurences

Figure 1. Location of 2002 study area (striped) and known kimberlites in relation to other KIM survey areas (*after* Sage 2000).

PHYSIOGRAPHY

The area surrounding the town of Elk Lake can be subdivided, on the basis of relative relief, into clayey and sandy lowlands interrupted by rocky uplands. Sandy plains pass gradually into rocky uplands to the north and east (Roed 1979a; Roed and Hallett 1979a). Elevation in this part of the study area ranges from 360 to 425 m asl, with some hills reaching 460 m asl. The Elk Lake area is of relatively low relief and is characterized by numerous bedrock outcrops and widespread sand plains. Elevations range from approximately 240 to 365 m asl. Most uplands are marked by prominent patterns of north-trending narrow valleys that are controlled by faults such as the Montreal River Fault system (Roed 1979a; Roed and Hallett 1979a). Drainage in the Elk Lake area is essentially controlled by bedrock structure. The southeasterly trending streams occupy prominent lineaments that strike roughly parallel to the Montreal River (MacKean 1968). As well, several streams are aligned in a northerly direction and are possibly fault controlled, as indicated by the Makobe River (MacKean 1968).

The New Liskeard lowland characterizes the southeast portion of the study area near New Liskeard. This lowland lies within a major fault-controlled rift valley (Roed 1979b; Roed and Hallett 1979b, 1979d). Much of the area is of low relief and underlain by glaciolacustrine clay-rich beds that were deposited in glacial Lake Barlow–Ojibway. The area is commonly known as the Little Clay Belt. Elevations range from 180 to 360 m asl (Roed 1979b; Roed and Hallett 1979b, 1979d). The main drainage system in this area comprises Wabi Creek and its tributaries. Wabi Creek drains southeastward along the strike of the lowest rift valley fault block and empties into Lake Timiskaming. Lake Timiskaming occupies a fault-controlled valley and is the largest lake in the area (Roed 1979b; Roed and Hallett 1979b, 1979d).

The western half of the southern part of the study area is dominated by rugged dissected uplands of the Cobalt Plain (Roed 1979c; Roed and Hallett 1979c). Some hills in this area reach elevations as high as 701 m asl. Large lakes in the area, such as Lady Evelyn and Anima Nipissing, drain to the north via small creeks into the Montreal River, which, in turn, flows into the Lake Timiskaming–Ottawa River system.

Bedrock Geology

The oldest rocks in the study area are Neo- to Mesoarchean (2.5 to 3.4 Ga) age and belong to the Abitibi Subprovince of the Superior Province. Located in the northeast corner of the survey area, rock units include granitic rocks of the Round Lake batholith, mafic to intermediate metavolcanic rocks and intrusive massive granodiorite and foliated tonalite suite rocks (Figure 2; Ontario Geological Survey 1991).

Most of the area surveyed is composed of lithologic units of the Southern Province and specifically the Paleoproterozoic Huronian Supergroup (2200 to 2450 Ma) (Ontario Geological Survey 1991). This Supergroup is subdivided into 4 groups, one of which, the Cobalt Group or the uppermost sedimentary cycle, is found in the study area. The Cobalt Group comprises, in ascending order, 4 formations: the Gowganda, Lorrain, Gordon Lake and Bar River (Bennett et al. 1991). Of interest to the present study are the Gowganda and Lorrain formations that make up the Cobalt Embayment. The Gowganda Formation consists of 2 members, the Coleman and Firstbrook. The Coleman Member is composed of pebbly wacke, argillite, conglomerate and quartzite (Lovell and Frey 1976a, 1976b, 1976c). The Firstbrook Member comprises argillite, siltstone, mudstone and metamorphosed sediments and conformably overlies the Coleman Member. The Lorrain Formation consists of arkose, quartzite, mudstone and contact metamorphic rocks (Born and Burbidge 1997) and conformably overlies the Gowganda Formation.

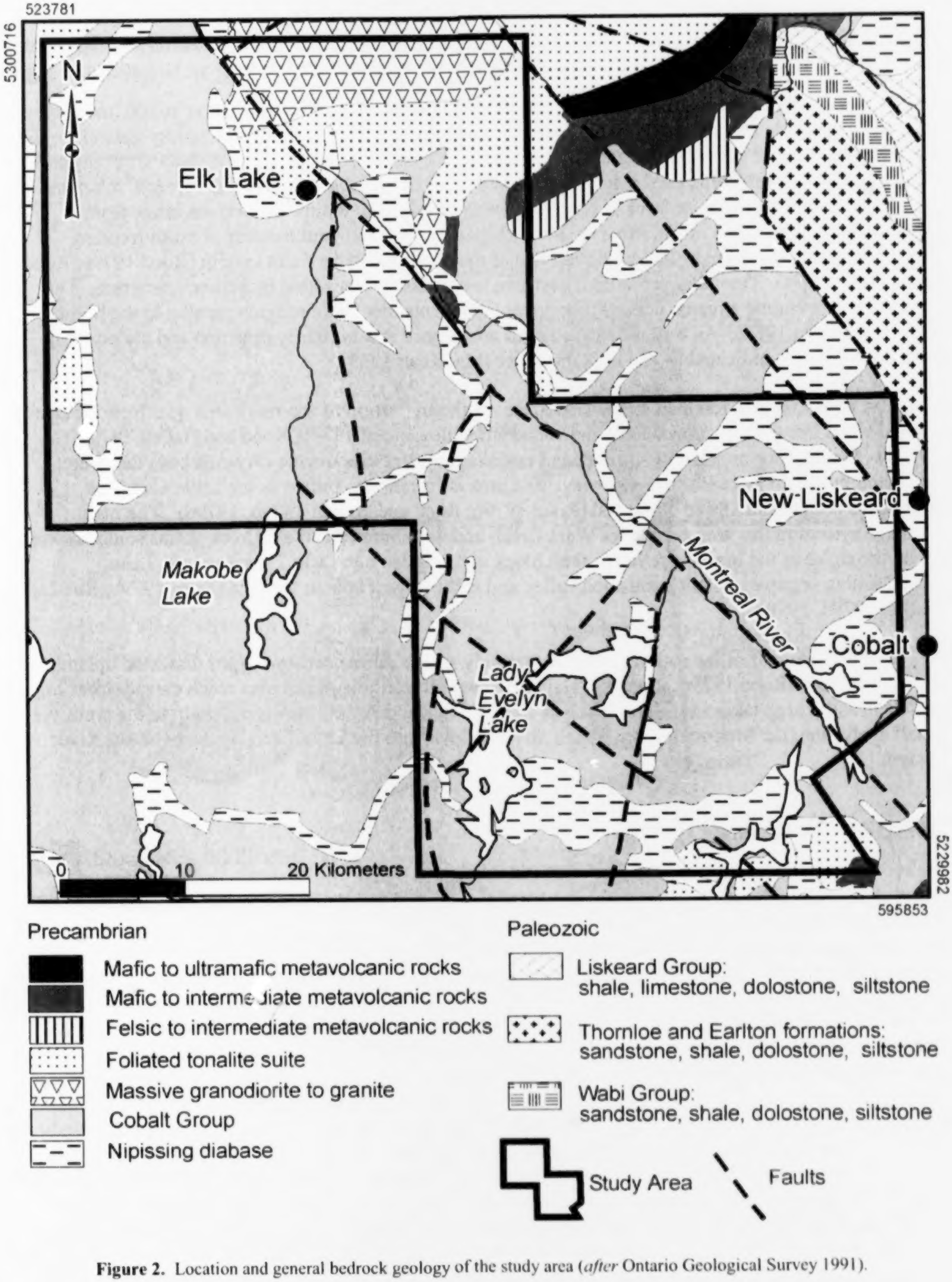
523781
5300716
N
Elk Lake
Makobe Lake
Lady Evelyn Lake
New Liskeard
Montreal River
Cobalt
0
10
20 Kilometers
5229982
595853
Precambrian
Mafic to ultramafic metavolcanic rocks
Mafic to intermediate metavolcanic rocks
Felsic to intermediate metavolcanic rocks
Foliated tonalite suite
Massive granodiorite to granite
Cobalt Group
Nipissing diabase
Paleozoic
Liskeard Group: shale, limestone, dolostone, siltstone
Thornloe and Earlton formations: sandstone, shale, dolostone, siltstone
Wabi Group: sandstone, shale, dolostone, siltstone
Study Area
Faults

Figure 2. Location and general bedrock geology of the study area (*after* Ontario Geological Survey 1991).

Intruding the Huronian Supergroup are Paleoproterozoic swarms of Nipissing Diabase dikes and sills (2219 Ma). Such rocks consist of diabase, gabbro, quartz gabbro, quartz diabase, varied-texture diabase and granophyre (Johns 1985; Johns and Van Steenburgh 1985). As well, a series of Mesoproterozoic (0.9 to 1.6 Ga) northwest-trending coarse- and fine-grained olivine diabase dikes known as the Sudbury swarm are found locally in the area (Ontario Geological Survey 1991).

Faults and joints in the bedrock are numerous and are evident in the terrain. Parallel, northwest-trending faults are prominent in the study area and include the Cross Lake and Montreal River faults (Roed 1979c; Roed and Hallett 1979c).

Quaternary Geology

During the Wisconsinan Episode, the study area was covered by glacial ice of the Laurentide Ice Sheet (Roed 1979a; Roed and Hallett 1979a). In general, glacial ice advanced south to southwestward across the study area (Barnett 1992). On the basis of glacial striae in the Timiskaming area, it has been proposed that 3 different stages of ice-flow direction affected the region (Veillette 1986). The oldest, a west-southwest flow (230 to 270°) and a younger, south-southwest flow (180 to 220°) were overprinted by the latest regional south-southeast ice flow (130 to 170°)(Veillette 1986). For the most part, only one set of striae, ranging from 180 to 210°, were observed during the course of the present study. These are thought to be related to the widespread south-southwest flow noted by Veillette (1986). Locally, in the Elk Lake area, 2 sets of striae were observed. An older set ranging from 205 to 210° was crosscut by a younger set of striae oriented at approximately 195°.

Glacial deposits in the Elk Lake–New Liskeard region are thought to be primarily of Late Wisconsinan age (Roed 1979a; Roed and Hallett 1979a). Advance of the Laurentide Ice Sheet across the area deposited a discontinuous cover of silty sand till (McClenaghan 1999a). By approximately 10 000 years ago, the glacial front had receded to the current area of study. Extensive esker and deltaic complexes, kames and kettles and the hummocky moraine north of Lady Evelyn Lake were deposited and represent a major stillstand of this ice sheet (Roed 1979c; Roed and Hallett 1979c). All of the eskers in the area are composed of sand, gravel, pebbles and some cobbles (MacKean 1968).

Approximately 9500 years ago, the ice front had receded well to the north of the map area. At that time, glacial Lake Barlow joined with glacial Lake Ojibway to form Lake Barlow–Ojibway. Meltwater from the Elk Lake valley emptied into this lake along the western part of the New Liskeard lowland (Roed 1979a; Roed and Hallett 1979a). Approximately 8700 years ago, obstructions along the Lake Timiskaming valley were breached and glacial Lake Barlow–Ojibway drained in several stages, eventually resulting in modern Lake Timiskaming (Roed 1979b; Roed and Hallett 1979b, 1979d). Thick deposits of fine-grained glaciolacustrine sediment associated with glacial Lake Barlow–Ojibway are found within the eastern part of the study area (Figure 3).

Other deposits associated with retreat of the ice front from the area include 1) glaciolacustrine deposits of sand and gravel, nearshore and beach deposits; 2) glaciofluvial outwash deposits of gravel and sand; and 3) localized fluvial deposits of gravel, sand, silt and clay (Barnett et al. 1991).

Recent deposits consist mainly of organic swamp deposits and lake sediments and are found throughout the survey area (Born and Burbidge 1997).

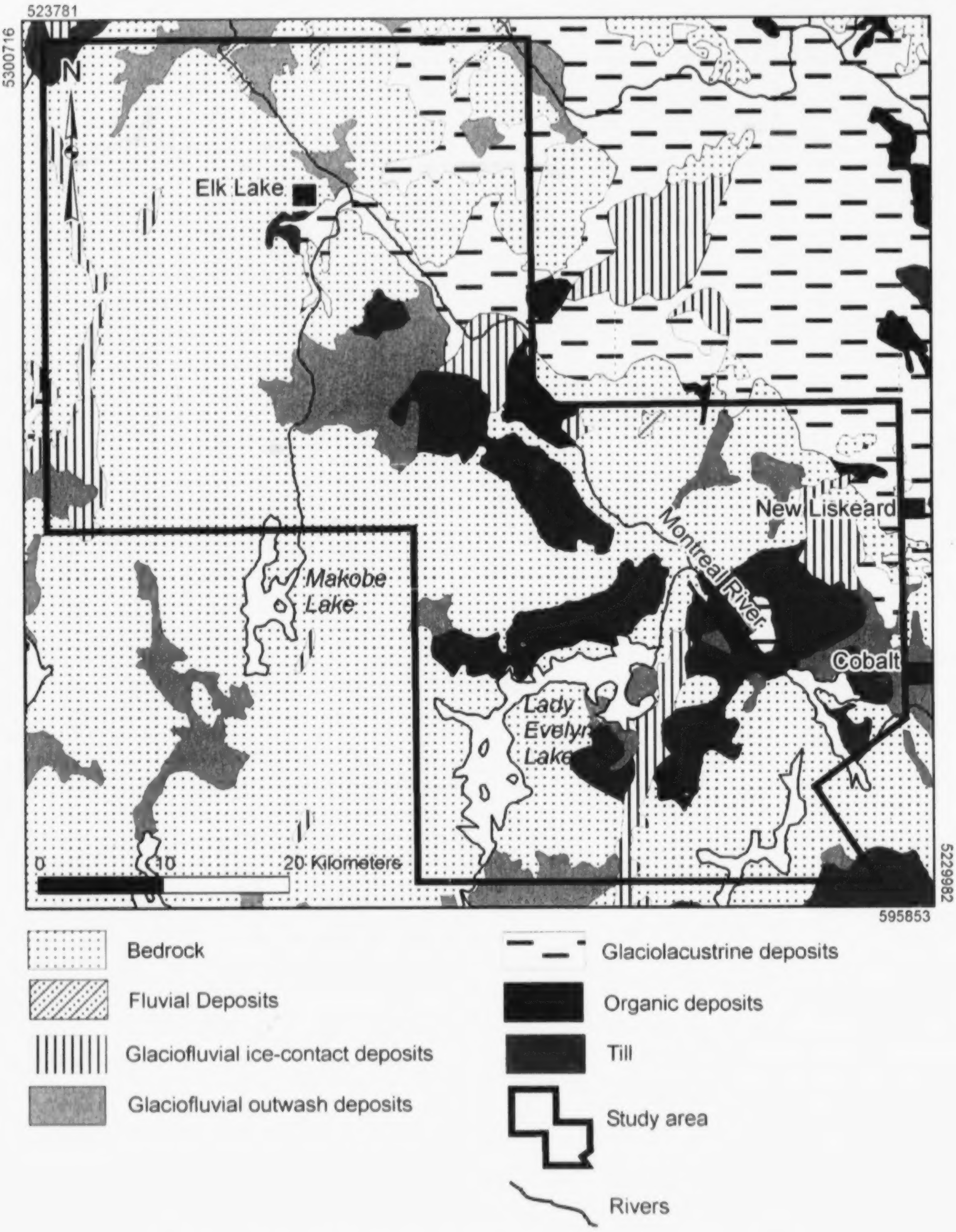
523781
5300716
N
Elk Lake
Makobe Lake
Lady Evelyn Lake
Montreal River
New Liskeard
Cobalt
0
10
20 Kilometers
5299982
595853
Bedrock
Fluvial Deposits
Glaciofluvial ice-contact deposits
Glaciofluvial outwash deposits
Glaciolacustrine deposits
Organic deposits
Till
Study area
Rivers

Figure 3. Generalized Quaternary geology of the study area (*after* Barnett et al. 1991).

Sampling Methodology

Regional overburden heavy mineral surveys provide data on the types, distribution and relative concentration of heavy minerals in a given region. The focus of the current sampling program was to provide regional information on kimberlite indicator minerals as well as MMSIMs and gold grains in the area.

The current regional modern alluvium survey, covering a total area of approximately 2850 km^2, was conducted in July and August 2002. A total of 175 modern alluvium samples, 2 till and 6 glaciofluvial sand and gravel samples were collected. Access to sample locations was achieved by truck, ATV, boat, float plane and helicopter. The resulting distribution of collected samples provides good regional coverage (Figure 4, back pocket). Regional overburden heavy mineral surveys provide data on the types, distribution and relative concentration of heavy minerals in a given region. The number of samples collected was predetermined by budget and time considerations. The position of each sample was accurately recorded with a global positioning system (GPS) instrument set to North American Datum 1983 (NAD 83), in UTM zone 17, and using NTS 1:50 000 scale map sheets. Sample numbers and locations (in UTM co-ordinates) are summarized in Appendix A (this report and MRD 124).

The primary objective of regional-scale surveys is to isolate anomalies that may indicate the presence of mineral deposits in the catchment area or possibly beyond. The heavy mineral signature obtained from modern alluvium is a product of the erosion of both bedrock and overburden, and the subsequent transportation and deposition of the eroded material (Morris et al. 2000). Stream sediments are characterized by variable composition, grain size, sorting and colour, all of which are a function of geology, terrain and climate of the catchment area sampled by the stream (Meyer et al. 1979). It is important to note, however, that lakes within drainage basins act as sediment traps, restricting the down-drainage transport of heavy minerals. Therefore, when modern alluvium sample sites were chosen for this survey, an attempt was made to maximize the length of stream section between the sample site and a lake. This maximizes the area of drainage basin sampled by the stream (Morris et al. 2000).

Modern alluvium was chosen as the primary sampling media for this study as it provides a means of obtaining a fast, relatively inexpensive heavy mineral signature for individual drainage basins (Morris et al. 2000). Points of heavy mineral deposition within streams were targeted for sample collection. Sampling points included the deepest part of the channel; longitudinal and point bars; and boulder, log and vegetation traps (Figure 5) (Morris et al. 2000). Material was sieved in the field using a 5 mm mesh screen and the finer (<5 mm) fraction was retained. Sample weights ranged from 10 to 20 kg. At some sites, larger samples were collected to compensate for either a high percentage of fine sand or silt material in the sediment or the dilution of heavy mineral grains caused by a high percentage of organic material. The finer (<5 mm) fraction of the sample was sent for heavy mineral processing to separate possible kimberlite and other indicator minerals. Where possible, approximately 50 pebbles were collected from the coarser (>5 mm) fraction at each sample site for pebble lithology classification. Pebble lithologies classified for the study indicate that, in general, stream deposits are locally derived. In addition, at each site, a small portion of the stream sediment was panned and the resultant "fine-fraction" concentrate retained.

At each sample location, a site description form was completed consisting of observations on 1) genesis of material, stream flow and depth; 2) surface expression; 3) slope inclination and aspect; 4) drainage; 5) vegetation type and state; 6) glacial features; 7) anthropogenic factors; 8) material description consisting of a) texture, b) structure, c) bar form and d) clast size, abundance, shape and type; and 9) diagrams and additional comments. Photographs were taken at several sites.

Pebble Lithology

Pebble lithology was determined by comparing the physical properties of pebbles to the local bedrock types. Pebble lithology studies provide a useful tool in determining whether the sediment in a stream is derived from a local or distal source. Pebbles similar to the bedrock types in the vicinity of the stream sample location indicate proximity to source. Exotic pebbles, those derived from bedrock located outside of the drainage basin sampled, indicate that transport has occurred over greater distances. In the fluvial (stream) environment, pebble shape may also reflect distance to source. An abundance of angular pebbles suggests local derivation, whereas a population of well-rounded pebbles may indicate longer transportation distances. However, the mineralogy of the pebble's rock type must be considered when using this approach as some easily weathered minerals may be quickly abraded in a stream environment. The resultant pebble may be rounded despite local derivation. Pebble lithologies identified in this survey include felsic and mafic intrusive rocks, gneiss, felsic and mafic metavolcanic rocks, sedimentary, quartz and others. The pebble lithology classification from this survey is summarized in Appendix J.

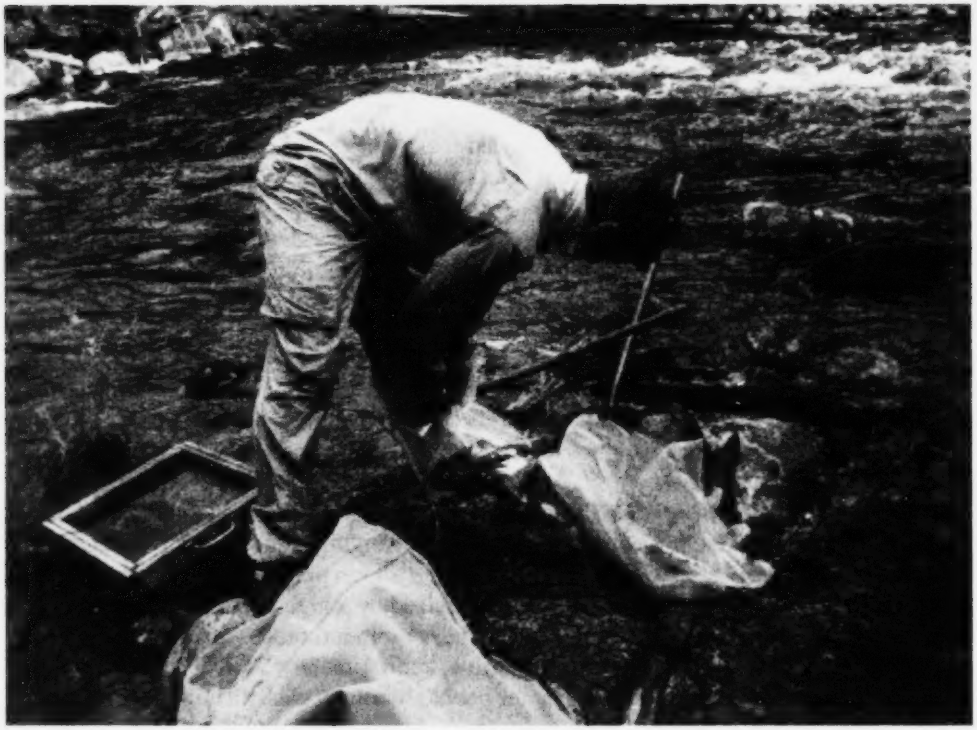

Figure 5. Photograph of sample site illustrating boulder traps. Alluvial gravel collects on the downstream side of the boulder making it ideal for sampling.

Heavy Mineral Recovery and Identification

All samples were sent for heavy mineral processing to isolate KIMs, MMSIMs and gold grains. Initially, weighed samples were wet sieved at 2 mm. The coarser (>2 mm) fraction was stored and the finer (<2 mm) fraction was passed over a shaking table to remove light (low specific gravity) material and to obtain a preliminary gold grain count. The table concentrate was panned and a secondary gold grain count performed. Heavy liquid separation (methylene iodide, specific gravity 3.2) was used to further concentrate heavy minerals. The heavy mineral concentrate then underwent ferromagnetic separation to obtain magnetic and nonmagnetic fractions. A series of various sieving and washing processes and additional magnetic separations were carried out to obtain the final concentrates for indicator mineral picking (Figure 6). Sample processing data are presented in Appendix B (*see* MRD 124). The isolated KIM and MMSIM grains were sent to the Ontario Geoscience Laboratories in Sudbury, Ontario, to determine, through microprobe analysis, the precise composition of critical indicator minerals.

During the picking process, 6 types of KIMs were isolated: chromium-pyrope (Cr-pyrope) garnets, eclogitic garnets, chromium-poor megacrystic garnets, chromite, chrome diopside (Cr-diopside), magnesium ilmenite (Mg-ilmenite) and forsteritic olivine. All identified grains were sent for microprobe analysis. The picking results and remarks for these minerals are outlined in Appendix C (*see also* MRD 124) and Appendix D (*see* MRD 124), respectively. Microprobe analyses are summarized in Appendix E (*see also* MRD 124).

A summary of recovered gold grains is listed in Appendix F (*see* MRD 124). Grains were classified by physical appearance into pristine, modified and reshaped categories. Additionally, estimated gold concentrations in parts per billion (ppb) were calculated for each sample.

Heavy mineral processing also recovered several types of MMSIMs®. These include chalcopyrite, pyrite, molybdenite, goethite, spinel (gahnite), corundum, Mn-epidote, Cr-grossular, low Cr-diopside, red rutile, kyanite, staurolite, spessartine, uvarovite, sillimanite, orthopyroxene, fayalite, forsteritic olivine, and chromite. Results are summarized in Appendix I (*see also* MRD 124). Only spinel, rutile, corundum, gahnite, low Cr-diopside, staurolite and chromite grains were sent for microprobe analysis.

Estimation of Grain Numbers and Data Normalization

For samples that contain large numbers of indicator minerals, it is neither time efficient nor cost effective to precisely count the absolute number of grains or pick the total number of grains of an abundant mineral present in that sample. Therefore, a representative subset of the grains was picked and an estimate made of the number of grains present. After isolated grains were analyzed by microprobe and their compositions confirmed, picking estimates were normalized based on the number of grains verified to be kimberlitic. For example, sample MA-077 was estimated to contain 200 chromites where 21 were picked and sent for microprobe analysis. Analysis revealed that 20 of the 21 chromites were, in fact, kimberlitic. Therefore, after normalization, the sample was considered to contain 190 chromites (*see* Appendix K for example calculation).

Normalization is not recommended except for unusual circumstances where abnormally high numbers of indicator minerals are present and only a select number of grains were picked from an estimated total number of grains (i.e., picked estimate normalization).

All normalized data and sample calculations are listed in Appendix K (*see also* MRD 124).

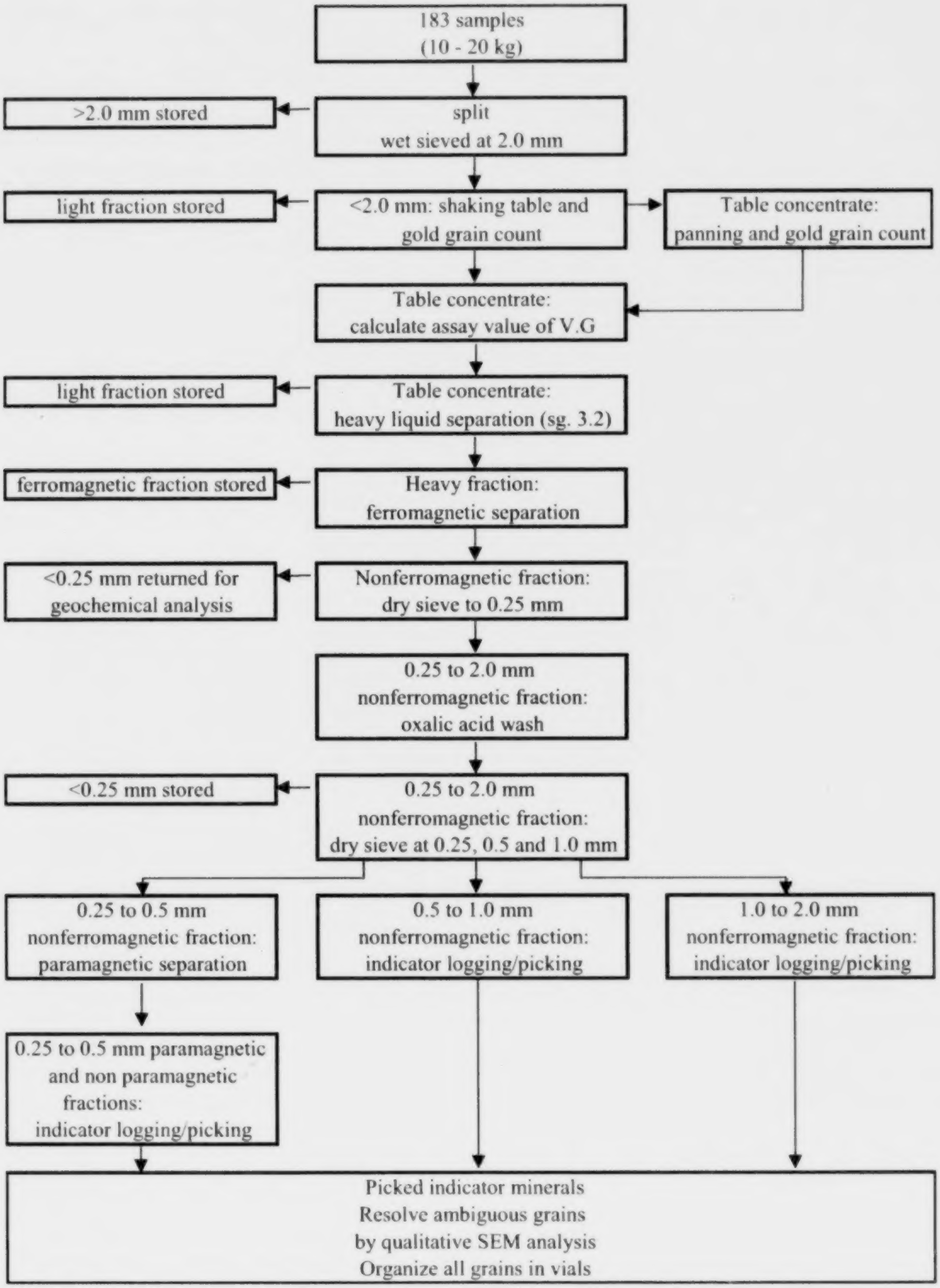
183 samples
(10 - 20 kg)
>2.0 mm stored
split
wet sieved at 2.0 mm
light fraction stored
<2.0 mm: shaking table and
gold grain count
Table concentrate:
panning and gold grain count
Table concentrate:
calculate assay value of V.G
light fraction stored
Table concentrate:
heavy liquid separation (sg. 3.2)
ferromagnetic fraction stored
Heavy fraction:
ferromagnetic separation
<0.25 mm returned for
geochemical analysis
Nonferromagnetic fraction:
dry sieve to 0.25 mm
0.25 to 2.0 mm
nonferromagnetic fraction:
oxalic acid wash
<0.25 mm stored
0.25 to 2.0 mm
nonferromagnetic fraction:
dry sieve at 0.25, 0.5 and 1.0 mm
0.25 to 0.5 mm
nonferromagnetic fraction:
paramagnetic separation
0.5 to 1.0 mm
nonferromagnetic fraction:
indicator logging/picking
1.0 to 2.0 mm
nonferromagnetic fraction:
indicator logging/picking
0.25 to 0.5 mm paramagnetic
and non paramagnetic
fractions:
indicator logging/picking
Picked indicator minerals
Resolve ambiguous grains
by qualitative SEM analysis
Organize all grains in vials

Figure 6. Heavy mineral concentrate process flow chart (*after* Averill 2001).

Geochemical Analysis, Results and Interpretation

KIMBERLITE INDICATOR MINERALS

Despite the number of potential bedrock settings for natural diamond occurrences, kimberlite has historically been regarded as the only significant primary host rock for diamonds (Helmstaedt 1993). The volcanic host rocks for diamonds, however, merely represent the agents to transport diamonds from the upper mantle to the surface. Kimberlite magmas must form at extreme depths (in excess of 150 km) in order to tap the diamondiferous portions of the subcratonic lithosphere (Ontario Geological Survey 2001). The proven diamond source rocks are various types of peridotite and certain high-pressure eclogites. Three types of peridotitic paragenesis are evident and are listed in order of relative importance with respect to diamond potential: garnet harzburgite, chromite harzburgite and garnet lherzolite (Gurney 1985). The transportation and subsequent disaggregation of these source rocks by kimberlite during the eruption process is the mechanism by which both diamonds and associated indicator minerals become liberated from their mantle host rocks.

The indicator mineral approach to kimberlite exploration relies on the recognition of distinctive mineral suites that are associated with potentially diamondiferous source rocks. Since these minerals are far more abundant than coexisting diamonds in the mantle environment and since kimberlite weathers quickly in the secondary environment, exploration programs focus on the recovery of indicator minerals rather than diamonds. The compositions of certain key indicator minerals, namely garnet, chromite, chrome diopside, olivine and ilmenite, have been used in diamond exploration to permit an assessment of diamond potential (Fipke et al. 1995).

Garnet

Garnet grains analyzed in this study include Cr-pyrope, pyrope, almandine, andradite, spessartine and grossular. Garnets in kimberlites can be derived from various sources including peridotites, eclogites, chromium-poor megacrysts and crustal rocks. Garnets of peridotite origin are typically chromium-rich pyropes and can originate from 5 different types of peridotite, the 2 most important being harzburgite and lherzolite. Cr-pyrope that occur as inclusions in diamonds are calcium-depleted, chromium-enriched and harzburgitic in origin (Gurney 1985). These types of garnets have been termed "G10" garnets (Dawson and Stephens 1975). Eclogitic and megacrystic garnets are also of primary interest as they are indicative of upper mantle derived material (Allan 2001). Megacrysts are thought to be phenocrysts in the kimberlite that formed at depths of 150 to 200 km. Therefore, they have no genetic connection with diamonds, which are xenocrysts in the kimberlite, but their presence in a pipe helps in ascertaining if that kimberlite has sampled a sufficiently thick lithospheric mantle keel to be potentially diamondiferous (Schulze 1999; Fipke et al. 1995).

Garnets recovered from modern alluvium sampling in this study were classified on the basis of a combination of geochemical parameters including weight % of Cr_2O_3, TiO_2, Na_2O, FeO and CaO. Peridotitic garnets are distinguished from eclogitic and crustal garnets in terms of Cr_2O_3 (weight %). Eclogitic garnets are typically chromium poor, whereas, in general, harzburgite and lherzolite garnets are chromium rich, displaying concentrations of Cr_2O_3 greater than 2%. These can be further subdivided into G9 and G10 classifications based on CaO concentration. On a CaO–Cr_2O_3 plot, 85% of diamond inclusion garnets fall on the calcium-enriched side of a diagonal line that parallels the lherzolite trend. This "diamond in" line (based on studies of South African diamondiferous kimberlites) separates G10 (calcium-depleted) garnets to the left and G9 garnets to the right. Given that garnet harzburgite has greater diamond potential than garnet lherzolite, G10 garnets with compositions that scatter well across the subcalcic field are the most important garnet indicators recovered in an exploration program (Gurney and Zweistra 1995). Very high diamond potential is indicated by G10 garnets that are <2.5 weight % CaO and >6 weight % Cr_2O_3 (Fipke et al. 1995). Additionally, peridotitic garnets can be classified according to a J-factor scale (Lee 1993). On a CaO–Cr_2O_3 plot, the areas defining G9 and G10 garnets have been subdivided into 10 zones that rate diamond potential from J1 to J10, where J10 represents a highly chromium-enriched, calcium-depleted G10 garnet.

Eclogitic garnets have Cr_2O_3 concentrations <2 weight % and can be isolated from crustal garnets and chromium-poor megacrysts on the basis of FeO, MnO and TiO_2 content. The first step is to screen out crustal garnets on the basis of FeO concentration where the FeO content of eclogitic garnets is <22 weight %. Care must be taken to exclude spessartine and grossular garnets from the data, as they will tend to plot with the eclogites at this stage. These grains can be screened on the basis of MnO (typically >1%) and CaO (typically >15%) (Ontario Geological Survey 2001). After eclogitic garnets have been isolated, the classification of group I and group II eclogites and compositional overlap with megacryst garnets can be carried out using a plot of Na_2O versus TiO_2 (Schulze 1999). Generally, only group I eclogites are considered diamond bearing. Garnets from these eclogites have a content of Na_2O >0.07 weight %, indicating equilibrium at high pressures compatible with diamond stability (Schulze 1999; Fipke et al. 1995). Group II eclogites are depleted in titanium and sodium. Megacrystic garnets also have Na_2O concentrations of <0.07 weight %, however, on this particular plot, they are also TiO_2 enriched, with concentrations of TiO_2 >0.4 weight % (Schulze 1999).

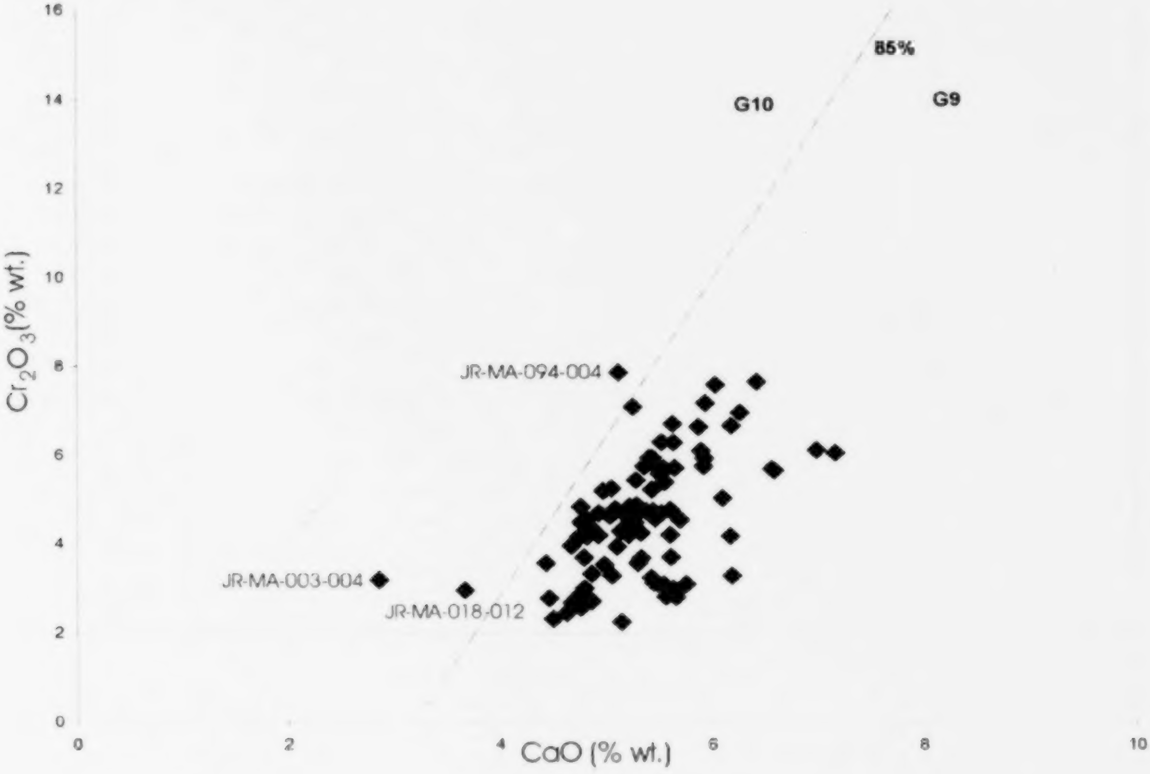

Figure 7. CaO versus Cr_2O_3 plot of G9 and G10 garnets recovered from the study area (*after* Dawson and Stephens 1975).

A total of 194 garnets were recovered from heavy mineral processing and sent for microprobe analysis. Precise geochemical classification determined the following distinctions: 3 G10 pyropes, 94 G9 pyropes, 20 Group II eclogitic garnets (ECLs), 35 chromium-poor megacrysts, 37 crustal garnets and 5 staurolites. Figure 7 shows the distribution of all compositional data on the lherzolite–harzburgite discriminant plot. A J-factor classification of all garnets (Figure 8) shows that the 3 G10 grains are distributed amongst the J2, J3 and J4 fields.

Chemical compositions of different garnet types are indicated on the graphs illustrating the classification process; G9 and megacrystic garnets on a Cr_2O_3–TiO_2 plot (Figure 9); eclogitic and crustal garnets on a FeO–TiO_2 plot (Figure 10); Group I and Group II eclogitic garnets and megacrysts on a Na_2O–TiO_2 plot (Figure 11) and eclogitic and megacrystic garnets on a Na_2O–CaO plot (Figure 12). The presence of 20 Group II eclogite garnets suggests that some of the eclogite source rocks sampled may have been diamond bearing. The presence of 3 G10 garnets suggests that the peridotite source was potentially diamond bearing. The KIM garnet signature for the study area is predominantly peridotitic in nature, as evidenced by the numerous G9 garnet grains recovered. Therefore, it can be inferred that any kimberlites or related rocks that may exist in the region sampled more mantle-derived peridotite than eclogite.

The regional occurrences of G10s, G9s, Group II ECLs and chromium-poor megacrysts are summarized in Figures 13, 14, 15 and 16, respectively. In all figures, it is obvious that the anomalous sites occur almost entirely within the southeastern part of the survey area. It is also interesting to note that almost all of the anomalous sites trend along the Lake Timiskaming Structural Zone. With the exception of the G9 grains, almost all of the anomalies are located on or very near the faults that occur within the

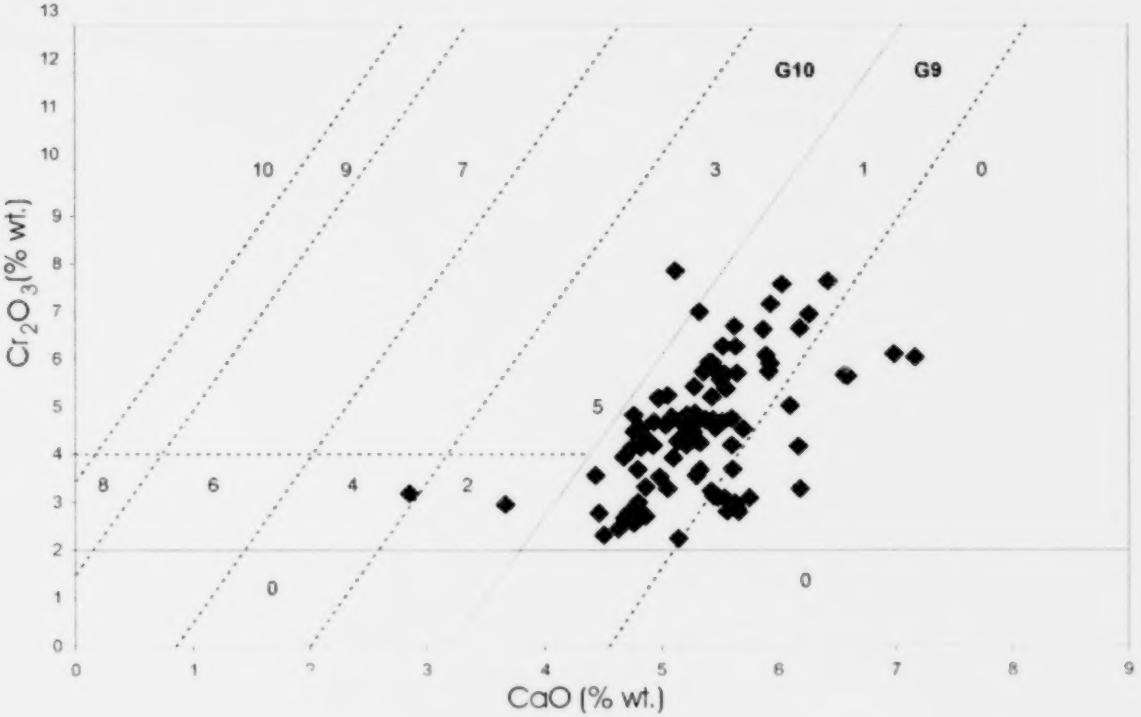

Figure 8. J-factor classification of all G9 and G10 garnets (*after* Lee 1993).

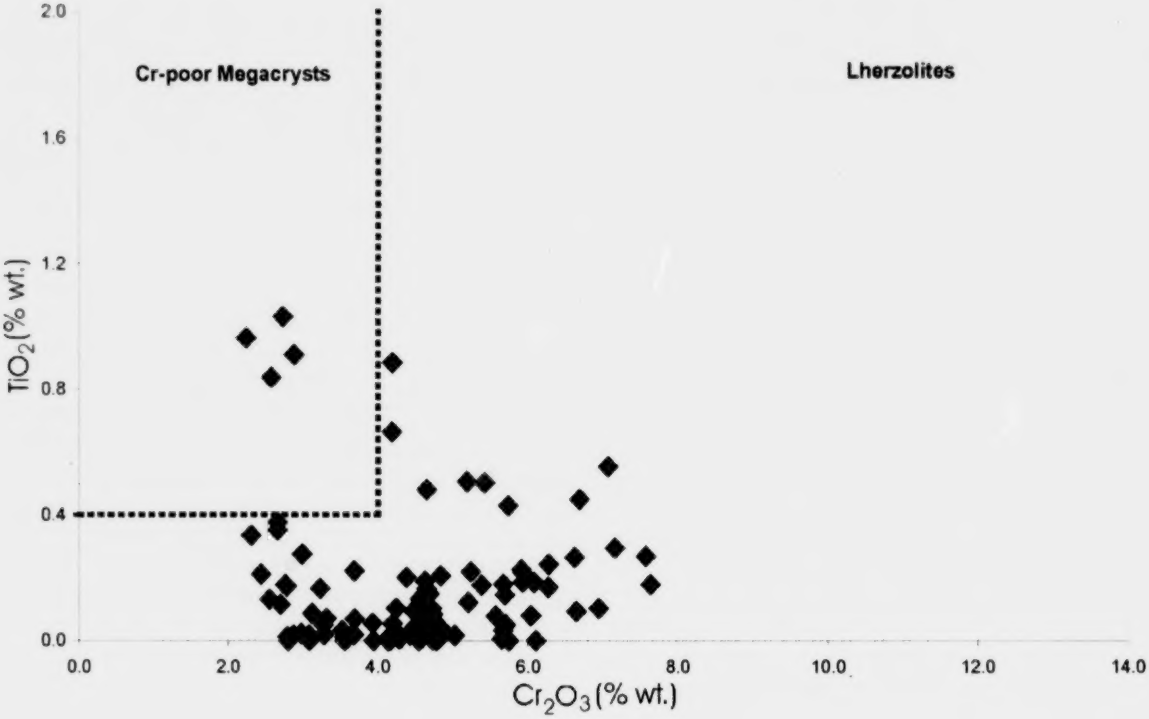

Figure 9. Cr_2O_3–TiO_2 plot showing lherzolitic garnets and chromium-poor megacrysts from the study area (*after* Schulze 1999).

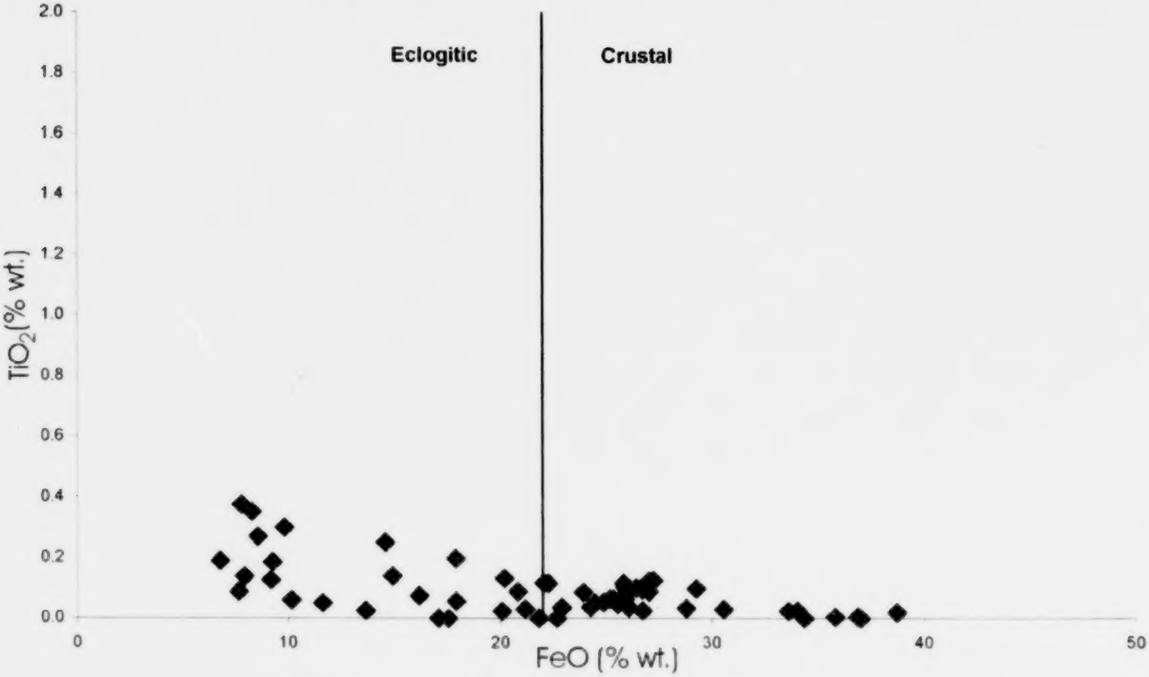

Figure 10. FeO–TiO_2 plot showing eclogitic and crustal garnets from the study area (*after* Schulze 1999).

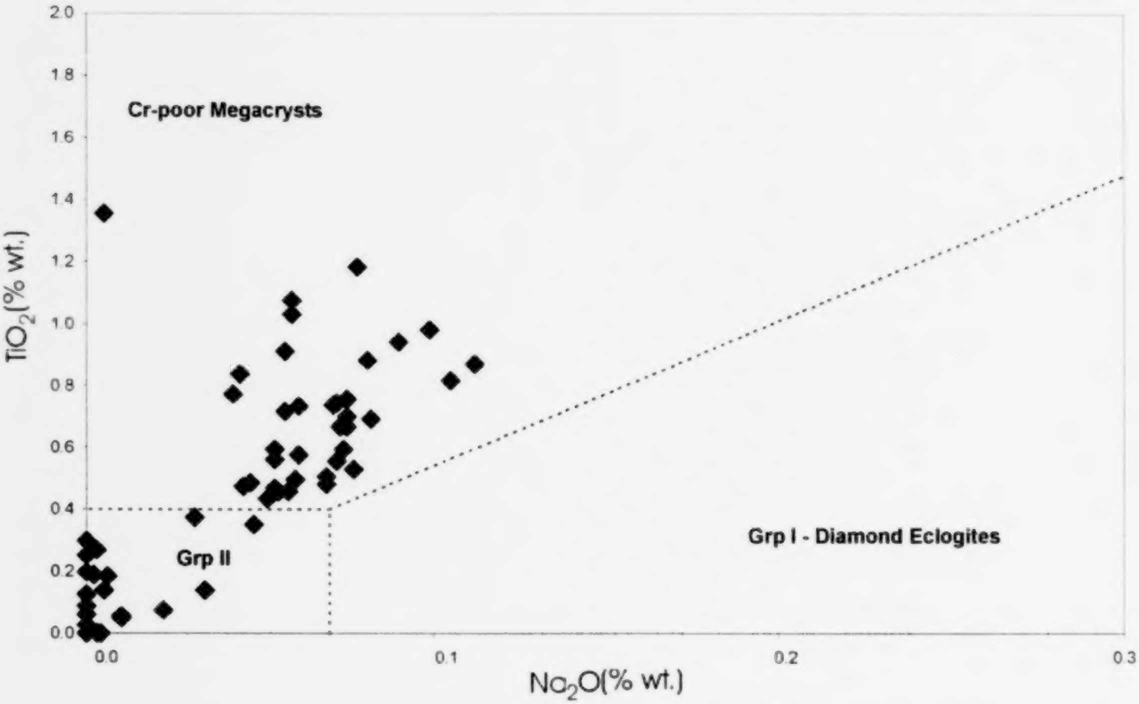

Figure 11. Na_2O–TiO_2 plot showing Group I and II eclogitic garnets and chromium-poor megacrystic garnets from the study area (*after* Schulze 1999).

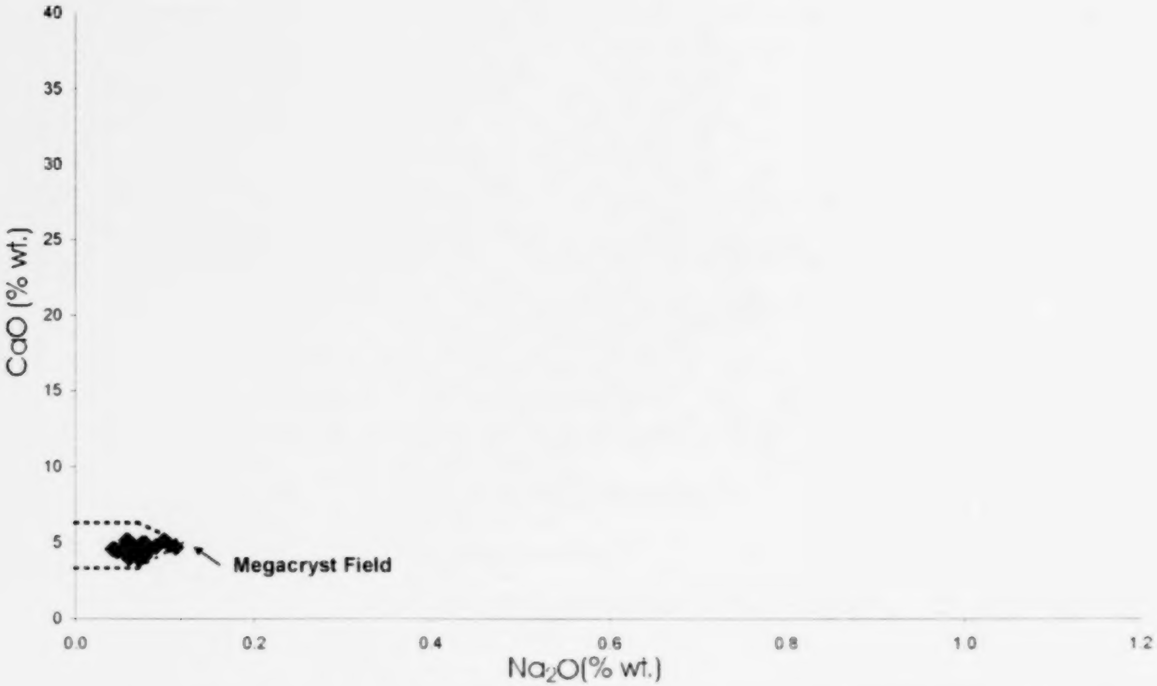

Figure 12. Na_2O–CaO plot of garnets from the study area and the megacrystic field (*after* Fipke et al. 1995).

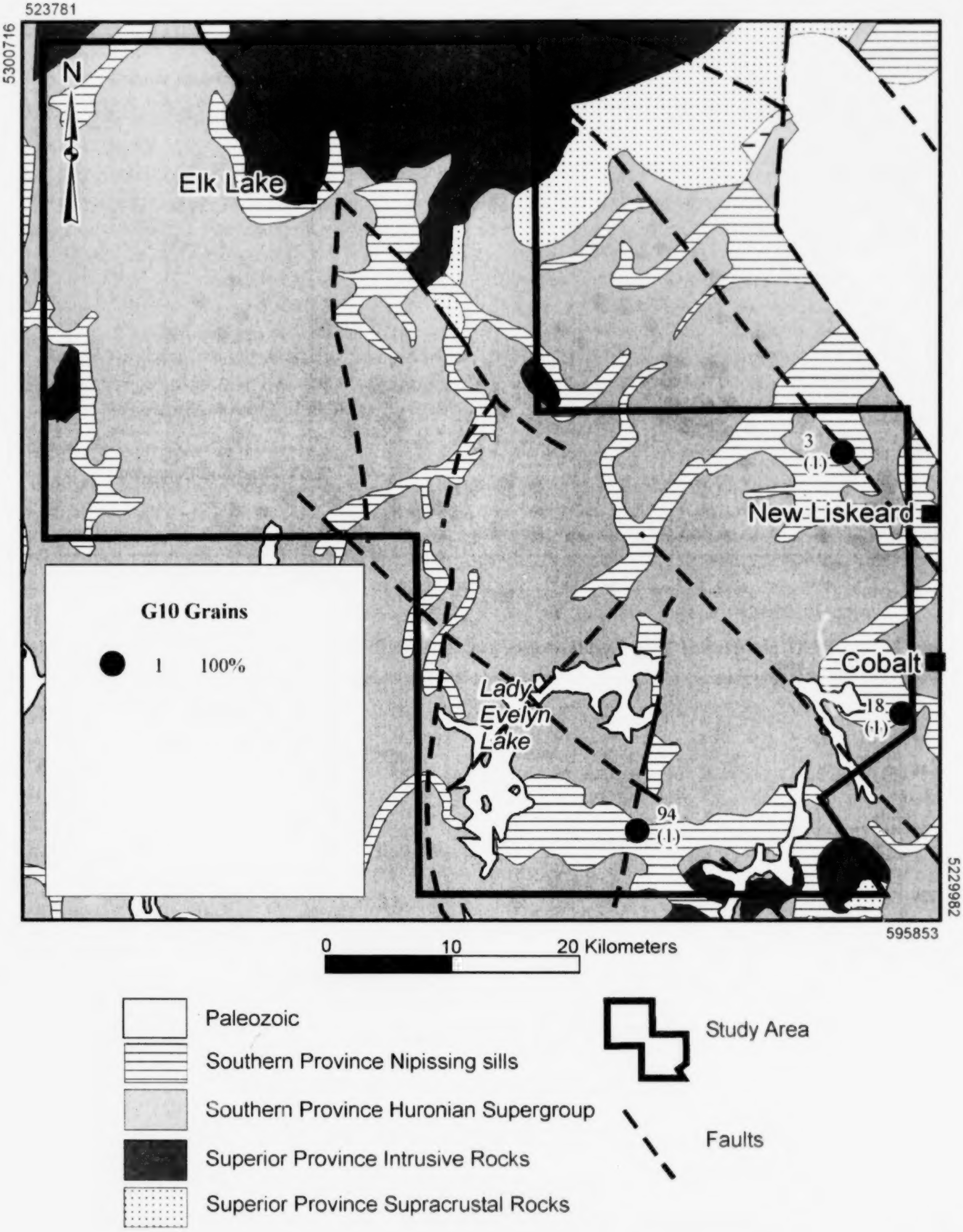
523781
5300716
N
Elk Lake
G10 Grains
● 1 100%
3
(1)
New Liskeard
Cobalt
18
(1)
Lady
Evelyn
Lake
94
(1)
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 13. Regional distribution of G10 garnet grains. Sites are labelled by sample number (note that the sample number prefix "02-JR-MA-0" has been omitted from the figure for clarity) with the corresponding number of grains shown in brackets.

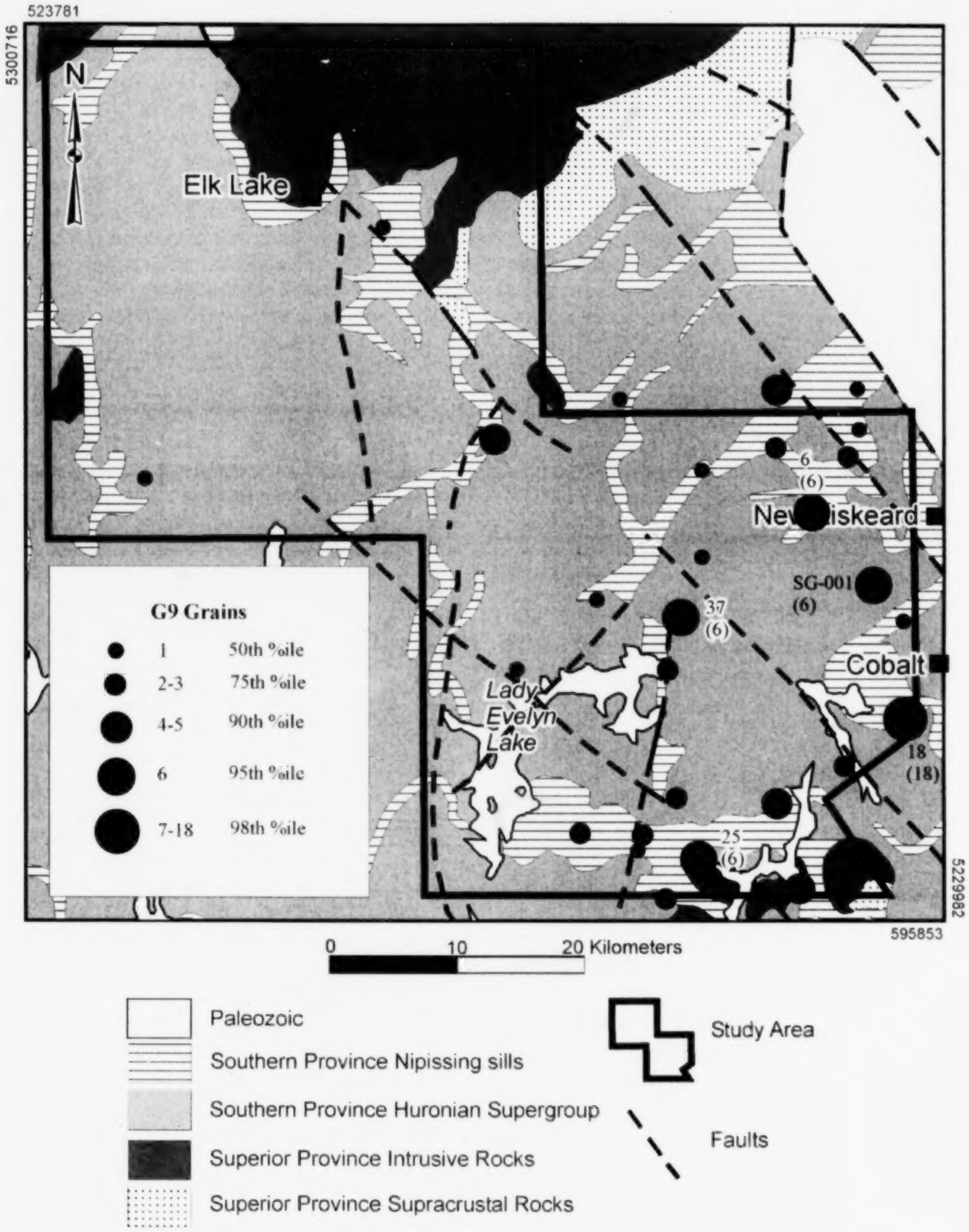
523781
5300716
N
Elk Lake
6
(6)
New Liskeard
SG-001
(6)
37
(6)
Cobalt
Lady Evelyn Lake
18
(18)
25
(6)
5229982
595853
G9 Grains
1 50th %ile
2-3 75th %ile
4-5 90th %ile
6 95th %ile
7-18 98th %ile
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 14. Regional distribution of G9 garnet grains. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

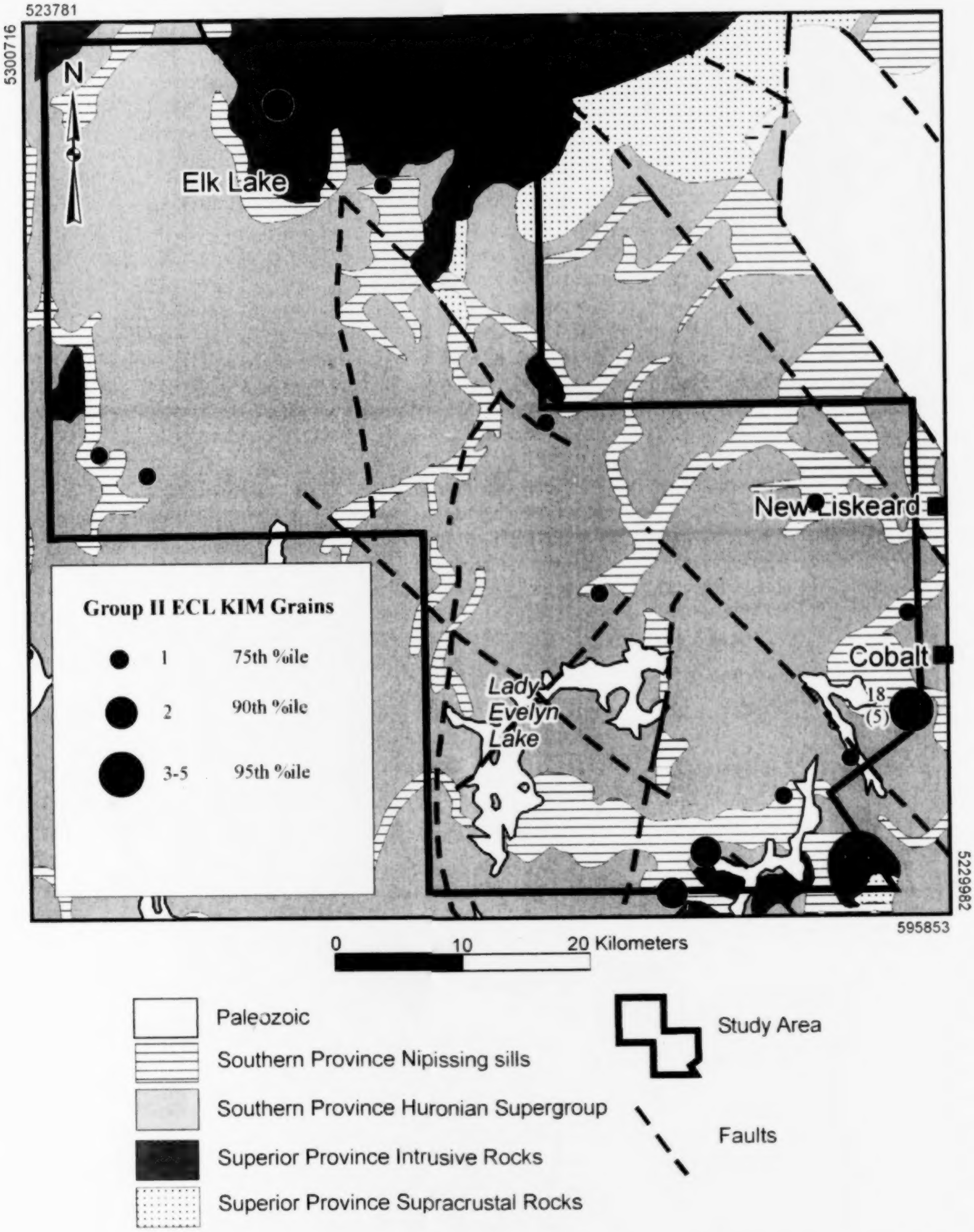
523781
5300716
N
Elk Lake
Group II ECL KIM Grains
1 75th %ile
2 90th %ile
3-5 95th %ile
Lady Evelyn Lake
New Liskeard
Cobalt
18
(5)
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 15. Regional distribution of Group II eclogitic garnet grains. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

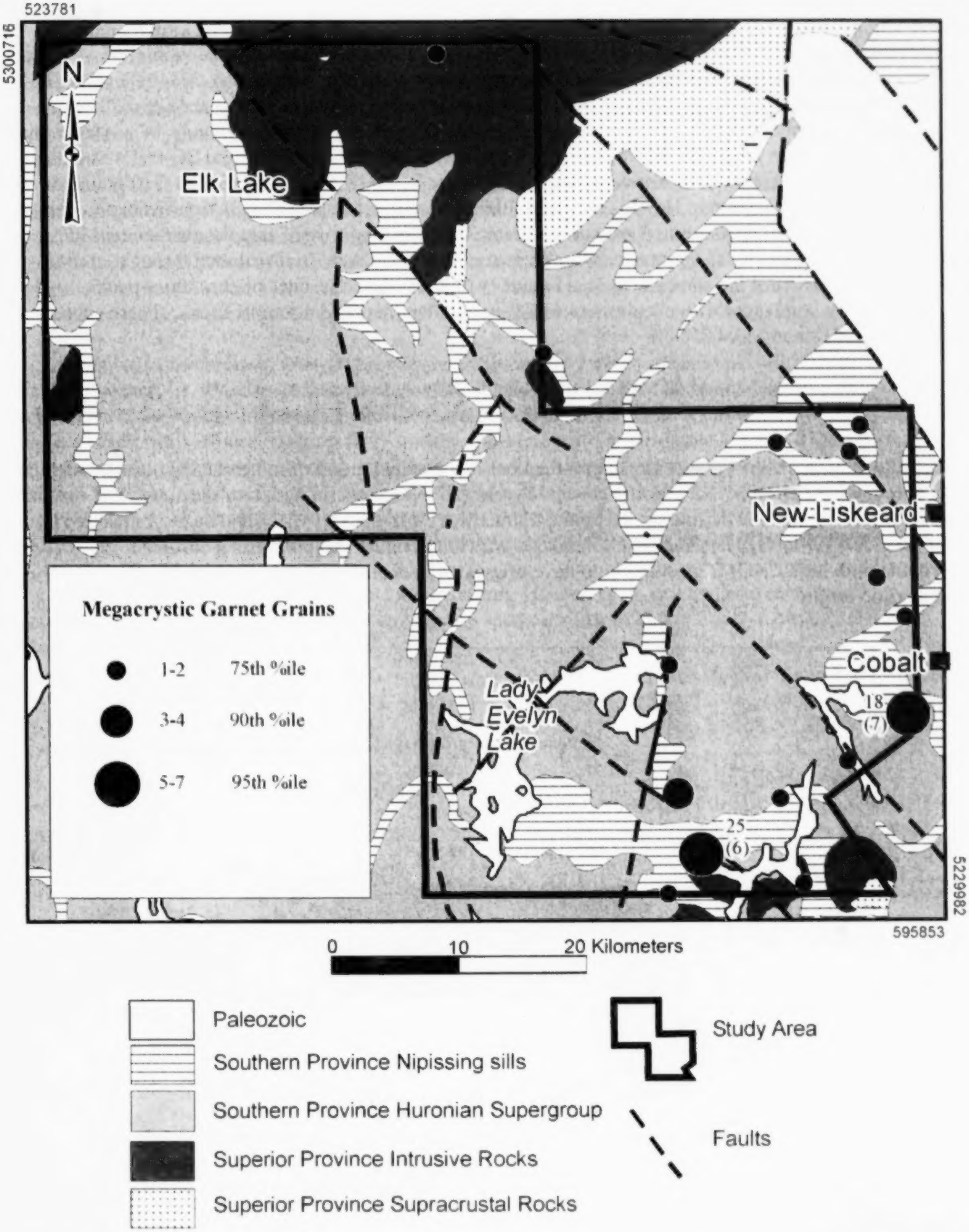
523781
5300716
N
Elk Lake
New Liskeard
Cobalt
Lady Evelyn Lake
18
(7)
25
(6)
Megacrystic Garnet Grains
● 1-2 75th %ile
● 3-4 90th %ile
● 5-7 95th %ile
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 16. Regional distribution of chromium-poor megacrystic garnet grains. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

Lake Timiskaming Structural Zone. It is within this structural zone where numerous kimberlite pipes have been identified. As illustrated in Figure 13, the 3 G10 garnet grains are located within the southeastern portion of the study area, in concentrations of 1 grain per sample (MA-003, 018, 094). The G9 garnet grains are much more numerous and are found throughout the study area, however, they are concentrated mainly over the same area as the G10s, that is, in the southeast (*see* Figure 14). Anomalous G9 sites (sites within the 95th or 98th percentile) include MA-006, 018, 025, 037 and SG-001. Anomalous G9 and G10 garnet grains were recovered from sample site MA-018 which contained 1 G10 grain and 18 G9 grains. Anomalous Group II ECLs are rare within the study area. However, 1 significant anomaly was identified, MA-018, yielding 5 grains (*see* Figure 15). The majority of samples that contain ECLs also contain G10s and G9s. Chromium-poor megacrystic garnets are also distributed throughout the southeastern portion of the survey area (*see* Figure 16). The anomalous sites of chromium-poor megacrysts are coincident with occurrences of G9 and G10 garnets and Group II ECLs. These sites include MA-018 and MA-025.

Chromites

Chromite represents one compositional end-member in the spinel group of minerals and occurs widely in mafic to ultramafic rocks. Kimberlitic chromite grains allow the determination of the amount of chromite harzburgite sampled and disaggregated by the kimberlite (Fipke et al. 1995). Evidence summarized by Griffin et al. (1994) suggests that Cr_2O_3 increases with temperature and pressure in chromite. Thus, chromite with high Cr_2O_3 is most likely to have originated at depth and can be interpreted to be of kimberlitic origin.

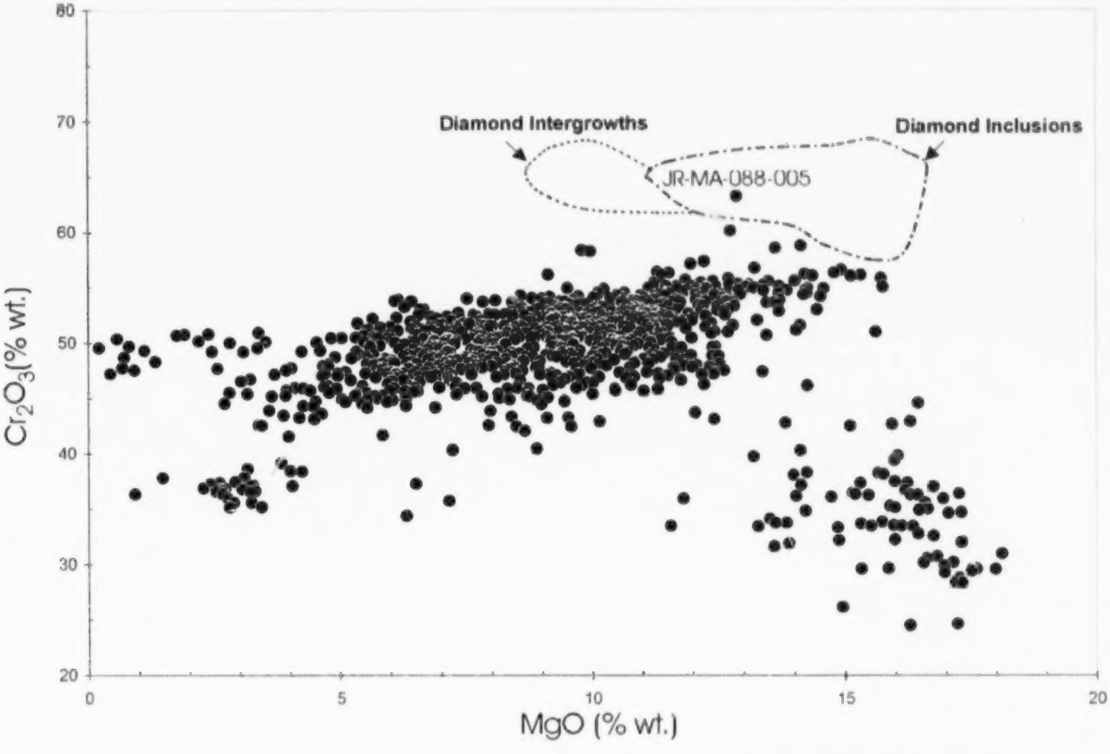

Figure 17. MgO–Cr_2O_3 plot of all chromite grains recovered from the study area (*after* Fipke et al. 1995).

Chromites have distinct compositional characteristics that can be used in exploration programs to determine diamond potential of an area. Chromites plotting in the diamond inclusion field generally contain concentrations of MgO >10 weight % and Cr_2O_3 >61 weight % (Figure 17). Finding such a chromite in surficial material or a rock sample is considered to be just as significant as finding a G10 Cr-pyrope garnet (Stephenson et al. 1999).

Fipke et al. (1995) proposed that the TiO_2 and Cr_2O_3 concentrations of chromites can be used to isolate kimberlitic and lamproitic chromites from other sources. In general, the largest population of chromites recovered during modern alluvium surveys is characterized by titanium-poor compositions (likely from a combination of crustal and mantle sources); these plot in the field of compositional overlap with other sources (Ontario Geological Survey 2001). However, chromites that plot in this overlap field may be considered as possible kimberlite indicator minerals.

A total of 1118 chromite grains were recovered (picked) by heavy mineral processing and sent for microprobe analysis. Precise geochemical classification resulted in the following distinctions: 1 diamond inclusion or intergrowth chromite, 29 considered to be unique to the kimberlites and lamproites, 1063 of possible kimberlitic affinity (overlap field) and 25 non-kimberlite or lamproite. Figure 17 illustrates the distribution of the compositional data on a MgO versus Cr_2O_3 plot. Sample MA-088-005 plots within the diamond inclusion field on the MgO versus Cr_2O_3 plot and is therefore considered a diamond inclusion chromite. Figure 18 illustrates the distribution of the data on the Fipke et al. (1995) TiO_2 versus Cr_2O_3 binary plot. The 1063 chromites that fall within the overlap field are considered as possible KIMs.

If the picked versus estimated grain counts for individual samples is taken into account, the estimated total number of recovered chromite grains increases from 1118 to 2464. Consequently, the

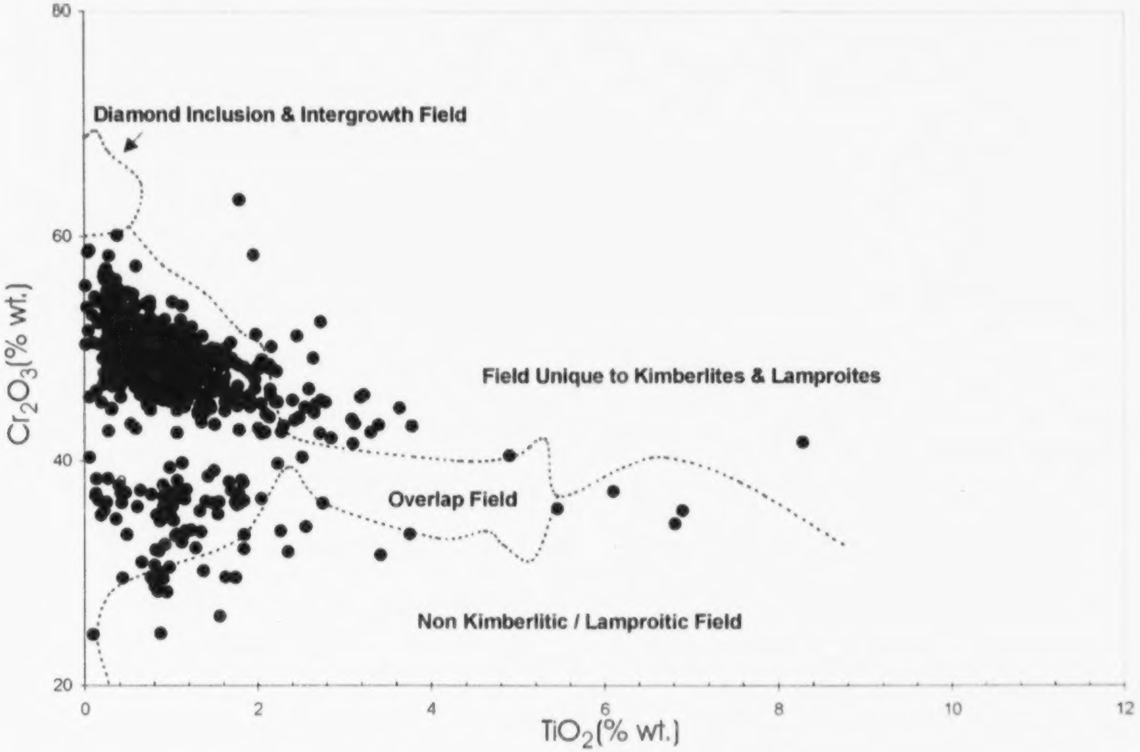

Figure 18. TiO_2–Cr_2O_3 plot of all chromite grains recovered from the study area (*after* Fipke et al. 1995).

number of possible KIMs increases to 2409 grains (2464 recovered grains minus the 29 unique field kimberlitic chromite grains, 1 diamond inclusion chromite grain and 25 non-kimberlitic chromite grains). The regional distribution of diamond inclusion chromites, total KIM chromite and total KIM chromites including those of possible kimberlitic affinity (overlap field) based on picked and estimated data are shown in Figures 19, 20 and 21, respectively. Information on samples in which the number of grains was estimated is summarized in Appendix K. Figure 20 shows that total chromite KIM grains are distributed throughout the survey area. Possible chromite KIM grains (*see* Figure 21) are also distributed throughout the area, however, there is a cluster of anomalous samples worth noting along the westernmost boundary of the survey area. The anomalous samples (samples that fall within the 95th or 98th percentile) located in this area include MA-077, 084, 141, 174 and SG-002. These anomalies contain as many as 450 grains at one site (estimated grain data). The large number of chromite anomalies found in this area could be due, in part, to the fact that chromite is the most resistant KIM species. These grains could have undergone reworking and transport dispersing them west-southwest of Elk Lake from the known Kirkland Lake kimberlite pipes. Additionally, these chromites could be related to the cluster of mafic to ultramafic metavolcanic rocks located directly west of the anomalous sites. The chromite grains may have been released into the secondary environment and transported downstream towards the Montreal River in the survey area.

Chrome Diopside

Chrome diopside (Cr-diopside) is not a definitive kimberlite indicator since it occurs in both kimberlite and other basic and ultrabasic rocks. It is, however, one of the major mineral components of the lherzolite peridotite assemblage and since lherzolites are not a major sources of diamonds, Cr-diopside can only be considered useful as a KIM and not as a diamond indicator mineral (Ontario Geological Survey 2001). Cr-diopside associated with lherzolitic rock is commonly considered to have high chrome values (>1.5 weight %) (McClenaghan et al. 1999b). More recently, Morris et al. (1999) have developed a ternary plot classification of Cr-diopsides, which has proven to be an excellent way of discriminating between Cr-diopsides derived from kimberlite and other sources. A ternary plot of Cr_2O_3–Al_2O_3–Na_2O has been used to define Cr-diopside derived from a deep mantle source as opposed to a shallow crustal source. For kimberlitic Cr-diopsides, the chromium values range from 1 to 40 molar weight % and Al_2O_3 ranges from 2 to 50 molar weight %. Na_2O ranges are related to chromium content. For example, when 1 molar weight % < Cr_2O_3 < 20 molar weight %, sodium values are 29 to 48 molar weight % and when Cr_2O_3 > 20 molar weight %, the sodium range increases from 19 to 58 molar weight %, but does not exceed 65 molar weight % (Allan 2001).

A total of 398 chrome diopsides were identified by microprobe analysis. The ternary plot of Cr_2O_3–Al_2O_3–Na_2O indicates that 48 grains could be classified as kimberlitic (Figure 22). Of these 48 kimberlitic Cr-diopsides, 17 were high Cr-diopsides (Cr_2O_3 >1.5 weight %). Of the remaining 350 non-kimberlitic clinopyroxenes, 342 contain between 0.5 and 1.5 weight % Cr_2O_3, 2 are high Cr-diopsides (Cr_2O_3 >1.5 weight %) and 6 are low Cr-diopsides (Cr_2O_3 <0.5 weight %). The grain data are summarized in Appendix E.

The distribution of kimberlitic Cr-diopsides in the survey area is illustrated in Figure 23. The Cr-diopside grains are scattered throughout the entire survey area. Anomalous sites include MA-003, 006, 018 and SG-002, each containing 3 or 4 grains per site. Because of the susceptibility of Cr-diopside to weathering, its presence can be used as a measure of proximity to source. This mineral disappears quickly once released into the surficial environment. Therefore, its recovery in a sample suggests local derivation. In this case, most Cr-diopside anomalies are found near New Liskeard, suggesting their source is kimberlite since clusters of kimberlite are known to exist in this area.

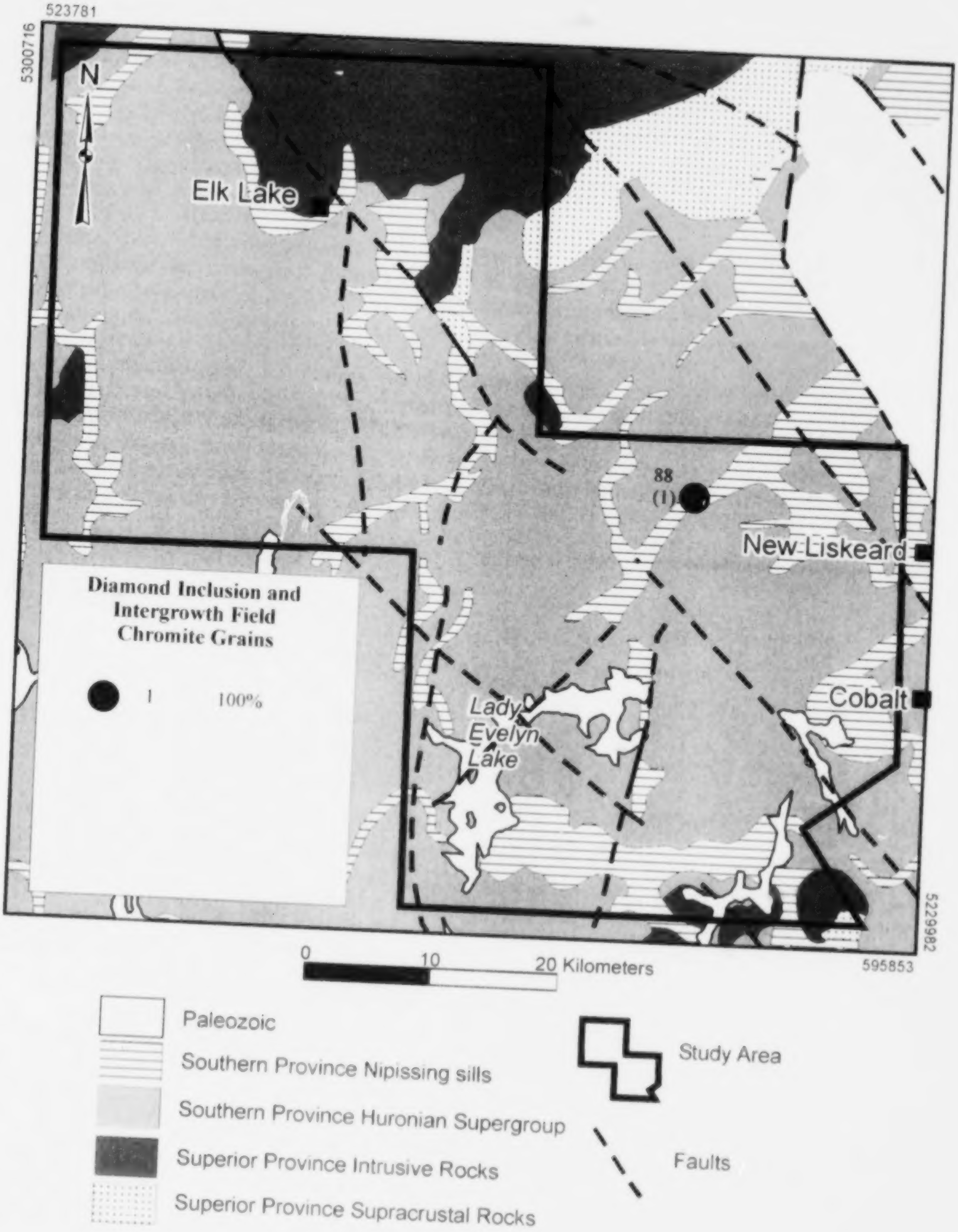
523781
5300716
N
Elk Lake
88
(1)
New Liskeard
Cobalt
Lady Evelyn Lake
Diamond Inclusion and Intergrowth Field Chromite Grains
1
100%
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 19. Regional distribution of diamond inclusion and intergrowth field chromite grains. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

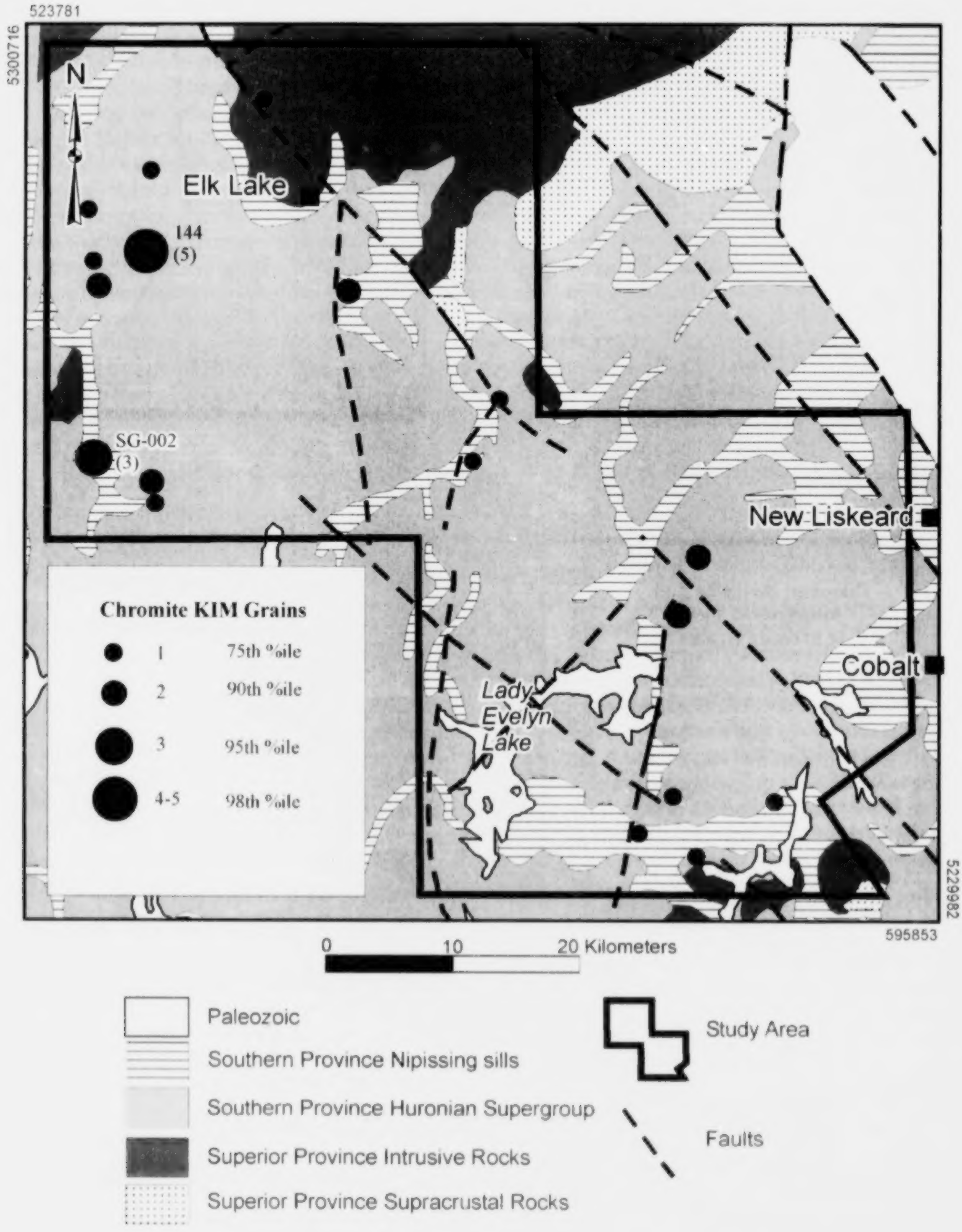
523781
5300716
N
Elk Lake
144
(5)
SG-002
(3)
New Liskeard
Cobalt
Lady Evelyn Lake
Chromite KIM Grains
1 75th %ile
2 90th %ile
3 95th %ile
4-5 98th %ile
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 20. Regional distribution of chromite KIM grains. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

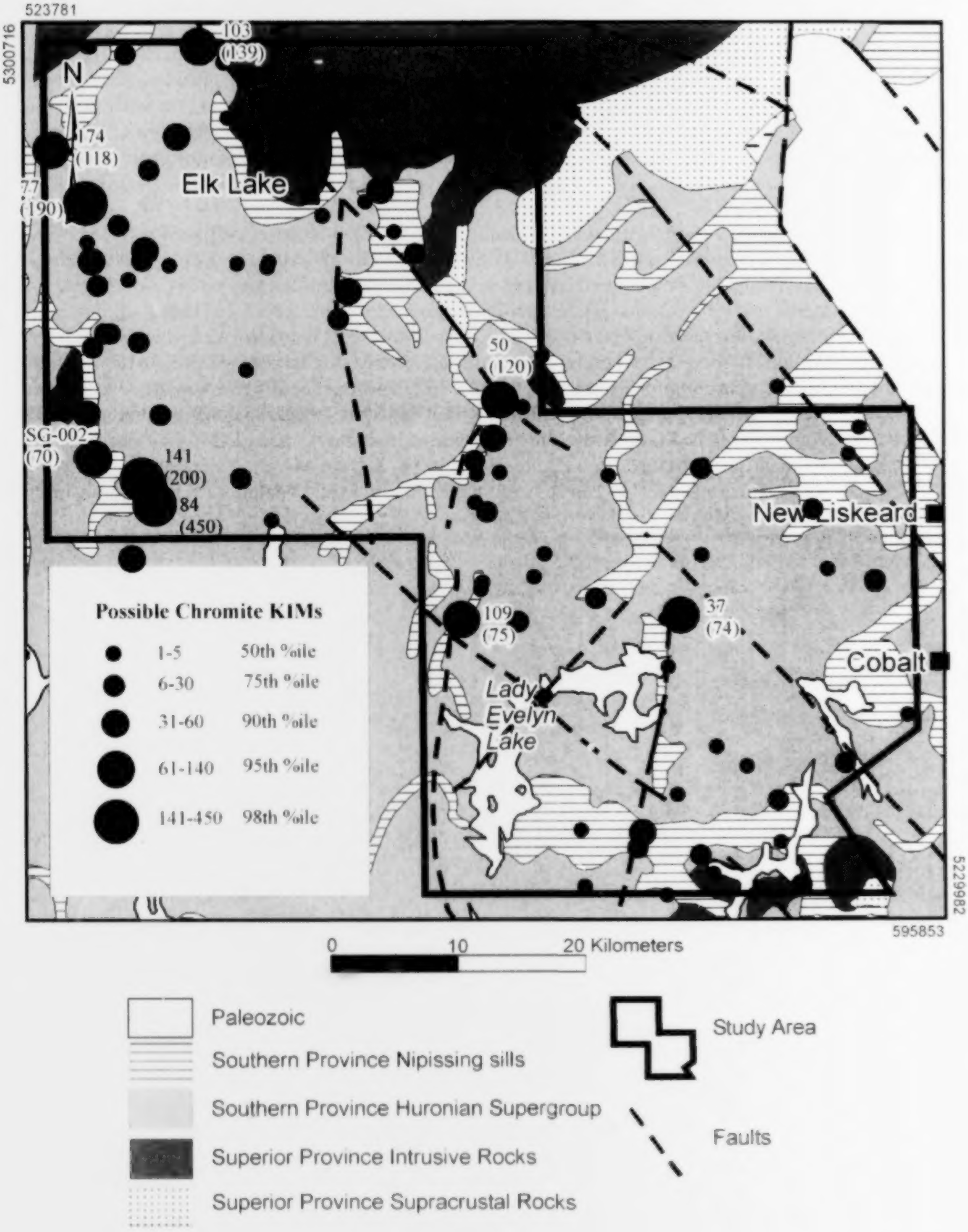
523781
5300716
N
103
(139)
174
(118)
77
(190)
Elk Lake
50
(120)
SG-002
(70)
141
(200)
84
(450)
New Liskeard
Cobalt
109
(75)
37
(74)
Lady Evelyn Lake
Possible Chromite KIMs
1-5 50th %ile
6-30 75th %ile
31-60 90th %ile
61-140 95th %ile
141-450 98th %ile
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 21. Regional distribution of possible chromite KIM grains (includes overlap field chromites). Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

An additional classification of kimberlitic Cr-diopsides was also used to examine the data. Figure 24 shows data on a binary plot of atomic Ca/(Ca+Mg) versus Na_2O weight %. Further constraints on mantle derived clinopyroxene compositions can be placed by projecting data on this plot. The choice of Na_2O as a variable on this diagram is important since there is a correlation between pressure and the amount of sodium that can enter the clinopyroxene structure in the form of the jadeite molecule ($NaAlSi_2O_6$) (Ontario Geological Survey 2001). This binary plot is based on Cr-diopside from both peridotite xenoliths carried in kimberlites (globally occurring) and xenocrysts from the Attawapiskat kimberlite field.

When 48 analyses that plot in the compositional field for mantle-derived Cr-diopside on the Cr_2O_3–Al_2O_3–Na_2O ternary plot (*see* Figure 22) are recast onto the Ca/(Ca+Mg) versus Na_2O weight % binary plot (*see* Figure 24), only 22 of the grains have compositional characteristics similar to Cr-diopsides found in subcratonic mantle xenoliths. Therefore, it is suggested that the use of 2 discriminating techniques is warranted for the Cr-diopsides found in the survey area. When the 22 Cr-diopsides identified as having mantle-type geochemical signatures are plotted, the anomalous sites are concentrated within the southeastern portion of the study area (Figure 25). The location of the anomalies is coincident with the presence of other KIM anomalies identified within this survey (*see* Figure 25). Sample MA-003, however, stands apart from the other Cr-diopside KIM grains in that it is anomalous within the 95th percentile, in both distribution figures (*see* Figures 23 and 25). Sample MA-003 contains 3 KIM Cr-diopside grains according to the Cr_2O_3–Al_2O_3–Na_2O ternary diagram and contains 2 KIM Cr-diopsides according to the Ca/(Ca+Mg) versus Na weight % plot.

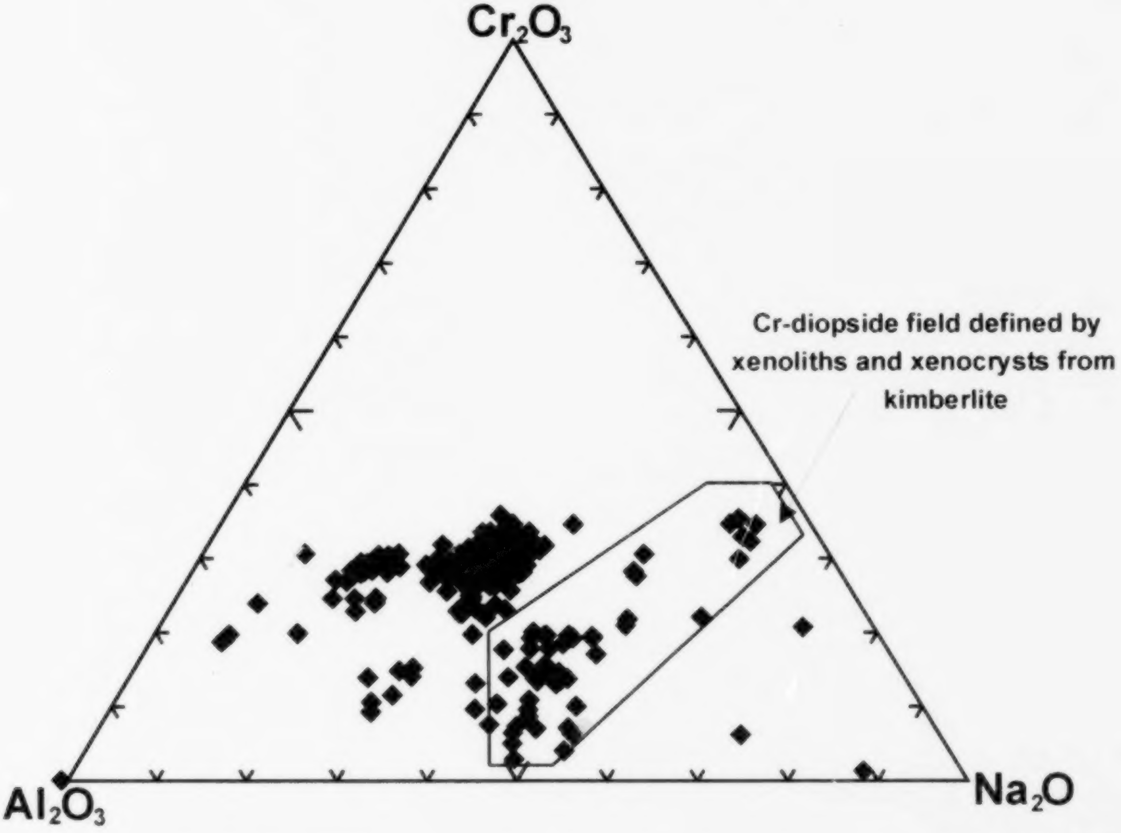

Figure 22. Ternary plot of Cr_2O_3–Al_2O_3–Na_2O showing all Cr-diopside grains from the survey area (*after* Morris et al. 1999).

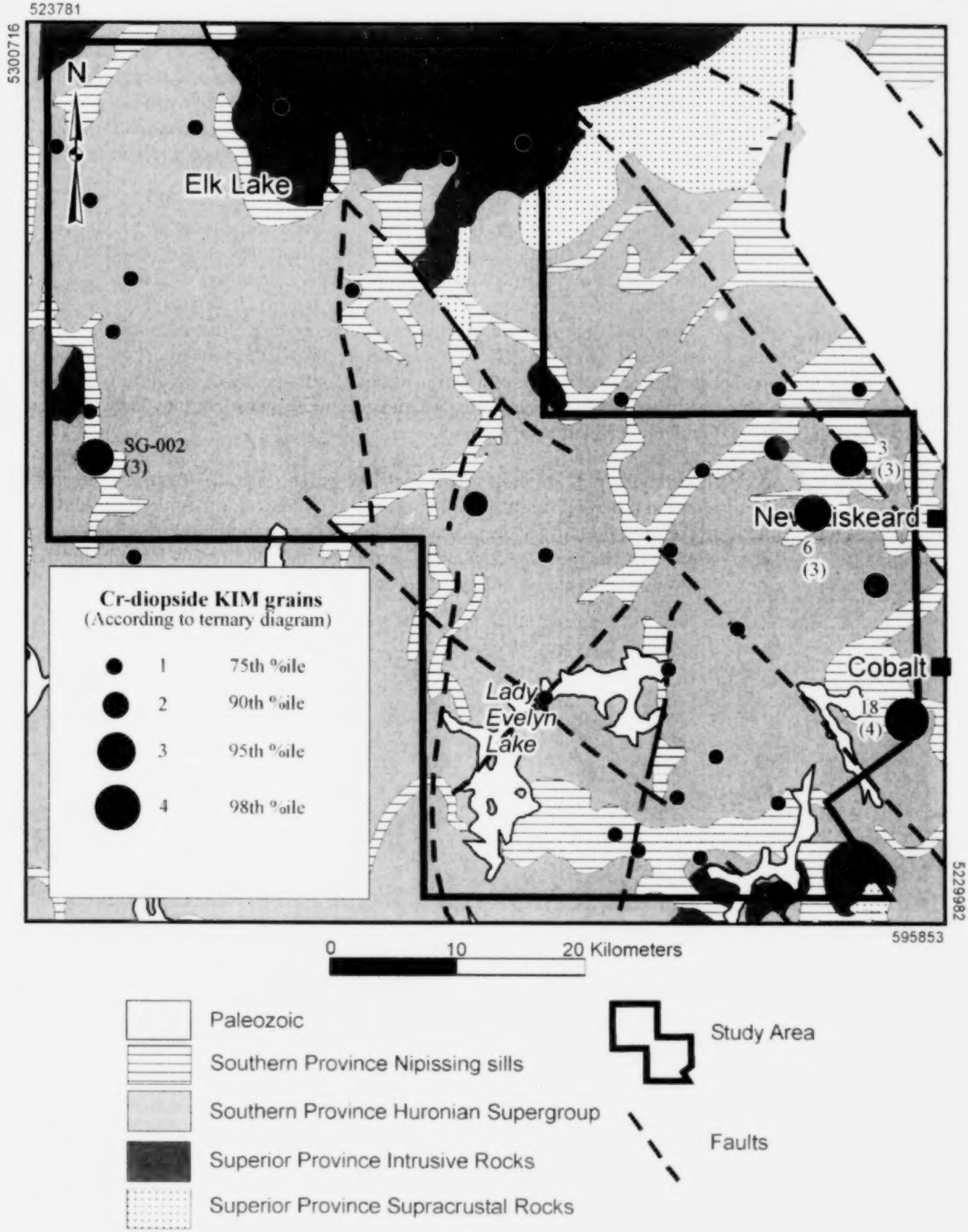
523781
5300716
N
Elk Lake
SG-002
(3)
3
(3)
New Liskeard
6
(3)
Cobalt
18
(4)
Lady Evelyn Lake
5229982
595853
Cr-diopside KIM grains
(According to ternary diagram)
1 75th %ile
2 90th %ile
3 95th %ile
4 98th %ile
0 10 20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 23. Regional distribution of Cr-diopside KIM grains that fall within the field shown on Figure 22. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

Ilmenite

Ilmenite is a common mineral in Ontario kimberlites (Sage 1996). Kimberlitic ilmenite is typically magnesium (4 to 16 weight %) and chromium (0.1 to 11 weight %) rich (Mitchell 1986) and can be readily distinguished from magnesium- and chromium-depleted ilmenite that is representative of crustal rocks. Ilmenite compositions are plotted on a MgO versus Cr_2O_3 parabolic plot in order to screen out compositions that are from crustal sources (MgO <4 weight %).

As the incorporation of the Fe_2O_3 molecule into the ilmenite structure is dependent on the oxygen fugacity (fO_2) in the kimberlitic magma (Hagerty and Tompkins 1983), ilmenite compositions may be used to predict whether magmatic conditions would have been favourable (reducing) or detrimental (oxidizing) for diamond preservation during kimberlite emplacement (Ontario Geological Survey 2001). Highly oxidizing conditions are known to promote diamond resorption and can remove up to 50% of the original diamond content (Gurney and Zweistra 1995). Ilmenites are abundant as macrocrysts in both kimberlite and its groundmass. Therefore, ilmenites are considered to be representative of both the depth and redox conditions of the magma chamber sampled and of subsequent changes that may have affected the kimberlite upon ascent and emplacement (Gurney and Zweistra 1995).

On a MgO versus Cr_2O_3 parabolic plot, ilmenites with MgO >8 weight % at increased concentrations of Cr_2O_3 indicate high preservation potential (reduced environment). In contrast, ilmenites with MgO <8 weight % with little or no concentration of Cr_2O_3 indicate less preservation potential (oxidized environment) (Fipke et al. 1995). The mantle source material had to be diamondiferous initially for the presence of diamond preservation ilmenites to be of any significance.

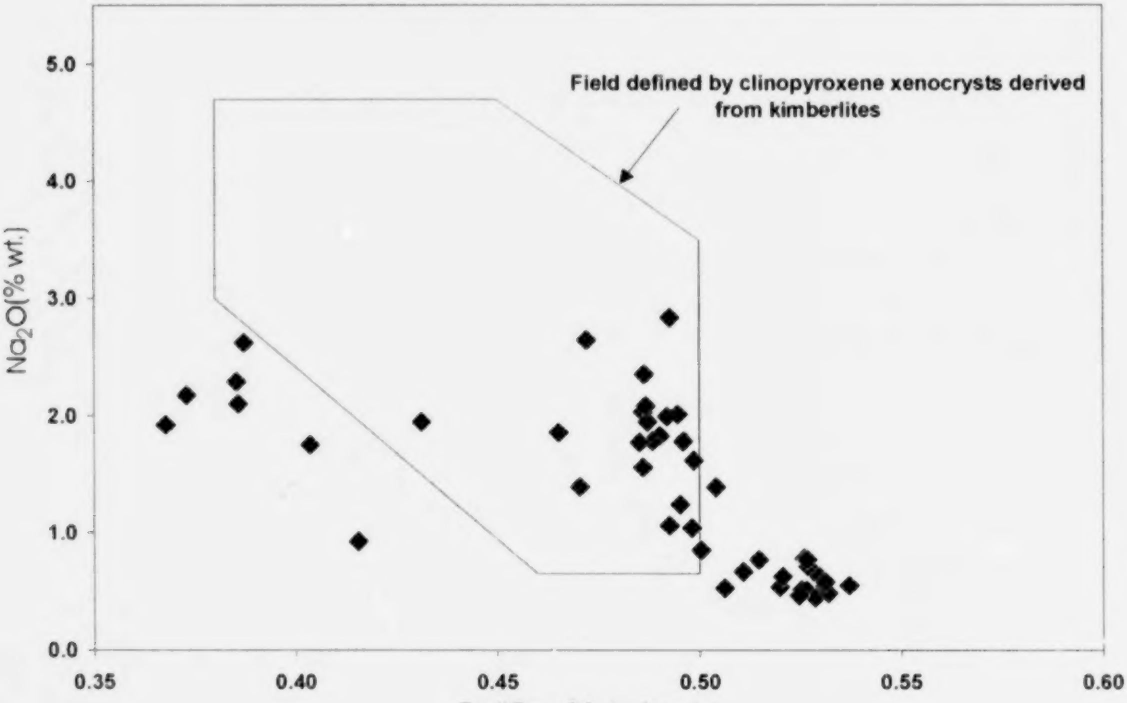

Figure 24. Ca/(Ca+Mg) versus Na_2O classification scheme for clinopyroxenes from the study area that plot within the field defined by mantle xenoliths and xenocrysts on the Al_2O_3–Na_2O–Cr_2O_3 ternary diagram (*see* Figure 22).

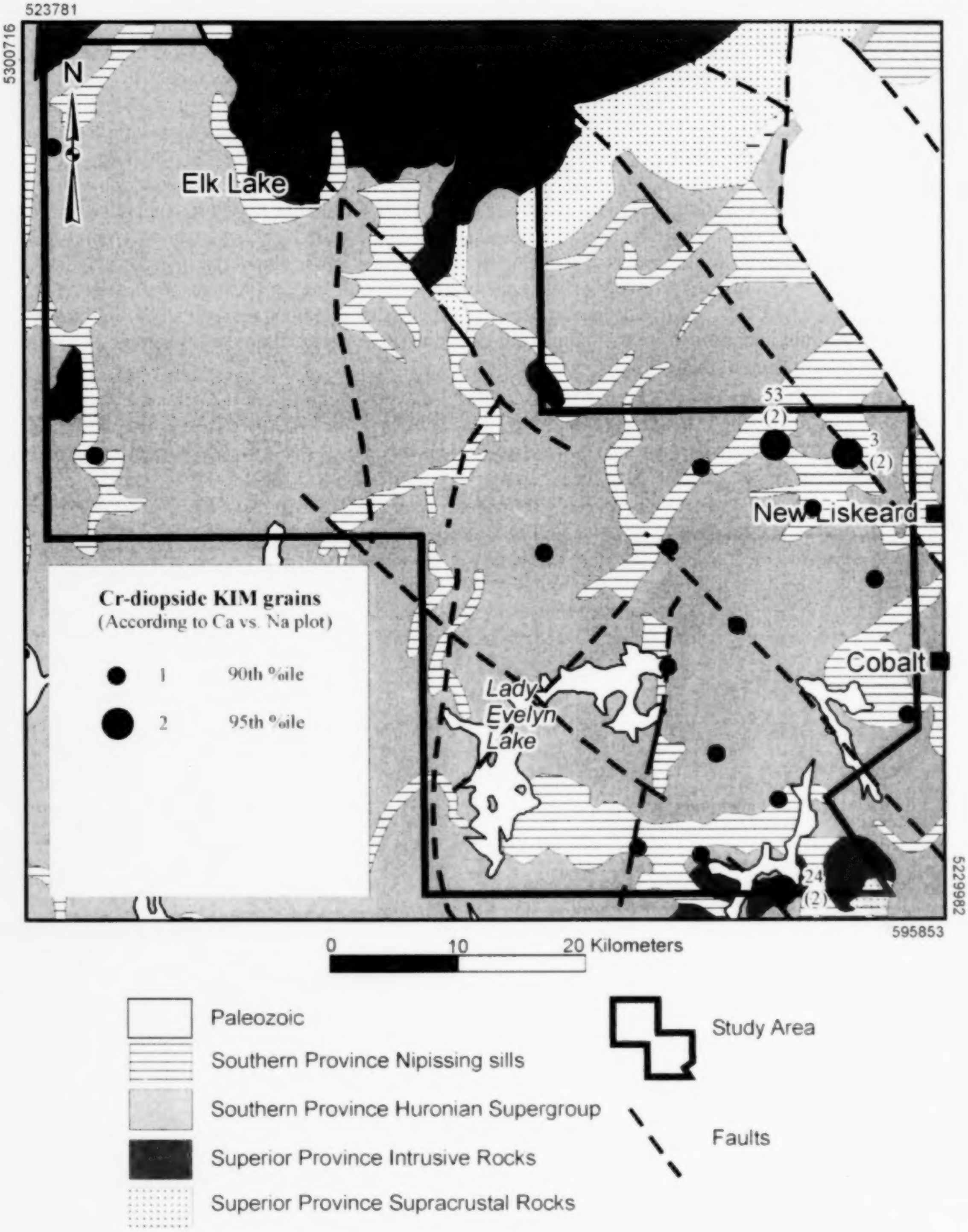
523781
5300716
N
Elk Lake
53
(2)
3
(2)
New Liskeard
Cobalt
Lady Evelyn Lake
24
(2)
5229982
595853
Cr-diopside KIM grains
(According to Ca vs. Na plot)
● 1 90th %ile
● 2 95th %ile
0 10 20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 25. Regional distribution of Cr-diopside KIM grains based on the Ca/(Ca+Mg)–Na_2O plot (*see* Figure 24). Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

A total of 359 ilmenites were recovered (picked) from heavy mineral concentrates and sent for microprobe analysis. Of the 359 ilmenites, 152 were classified as KIMs and 207 were considered to be crustally derived. The KIM ilmenite population ranges in MgO content from 5.4 weight % to 13.5 weight % (Figure 26). The majority of the grain population is greater than 8 weight % MgO with varied Cr_2O_3 content. If the number of picked versus estimated grain counts for individual samples is taken into account, the total number of recovered ilmenite grains increases from 359 to 380 and, therefore, the number of possible KIMs increases from 152 to 173 grains. Data for samples, for which the total number of ilmenites present is based on analyses of a picked subset, are shown in Appendix K. The regional distribution of the ilmenite KIM grains, based on estimated grain numbers is shown in Figure 27. Ilmenite anomalies follow similar trends as those observed for other KIMs recovered in the survey. That is, the majority of the anomalies fall within the southeastern section of the survey area. Two major anomalies, samples MA-007 and 018, contain 65 and 36 ilmenite KIM grains, respectively. The presence of 1 G10 garnet grain in combination with numerous diamond preservation ilmenites in sample MA-018 increases the significance of these ilmenite grains.

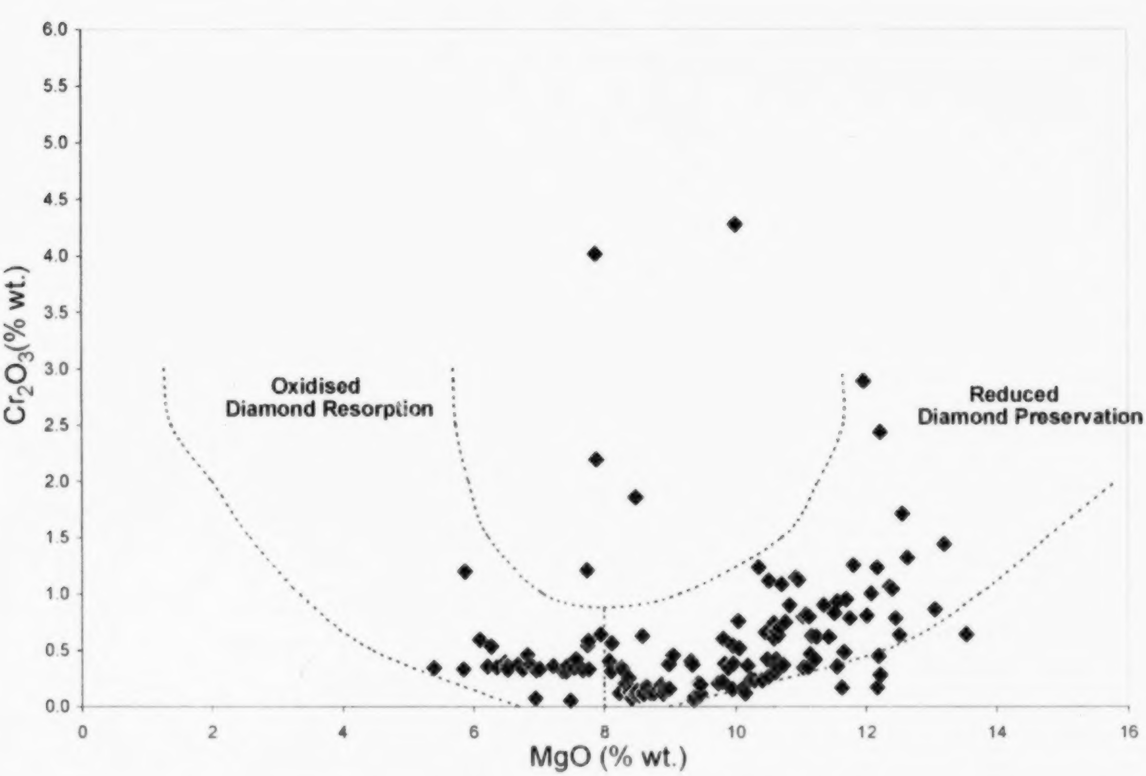

Figure 26. MgO–Cr_2O_3 plot of kimberlite ilmenites (>4 weight % MgO) from the survey area (*after* Gurney and Moore 1991).

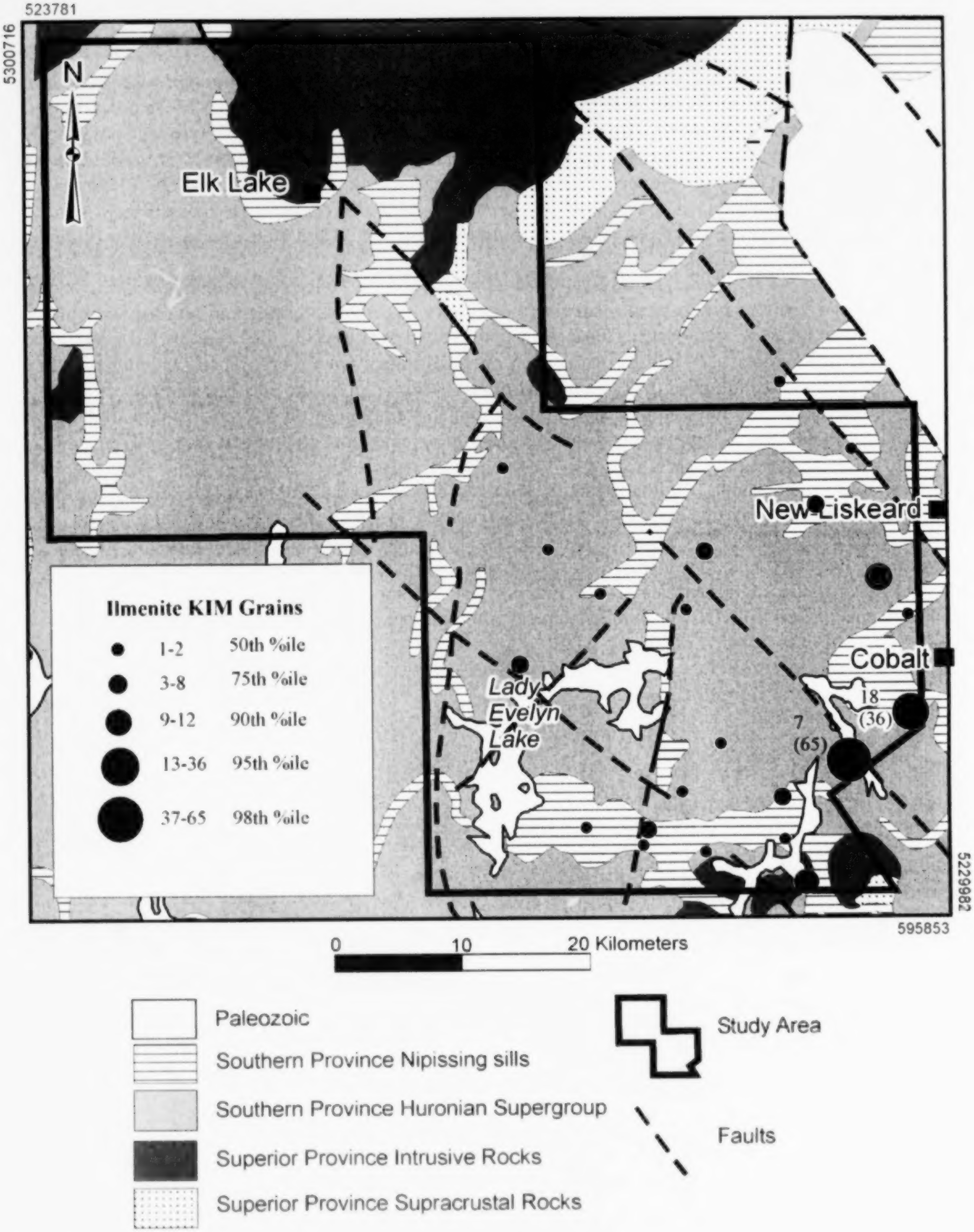
523781
5300716
N
Elk Lake
New Liskeard
Cobalt
Lady Evelyn Lake
18
(36)
7
(65)
Ilmenite KIM Grains
● 1-2 50th %ile
● 3-8 75th %ile
● 9-12 90th %ile
● 13-36 95th %ile
● 37-65 98th %ile
5229982
595853
0 10 20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 27. Regional distribution of ilmenite KIM grains. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

Olivine

Forsteritic olivine is a characteristic mineral in kimberlite, but it is not unique to kimberlite as it can occur in a range of ultramafic supracrustal and plutonic rocks (Stone 2001). Also, olivines break down quite readily during transport and are easily weathered resulting in chemical breakdown. Olivine is often completely altered in many kimberlites, such as the Kirkland Lake pipes (Sage 1996). This could be the reason for the lack of olivines recovered in this survey. According to Morris et al. (2000), forsteritic olivines with MgO numbers (MgO/(MgO+FeO)) greater than 90 are considered to be associated exclusively with kimberlite and those with MgO numbers between 80 and 90 are considered to be derived from mafic or kimberlitic sources.

A total of 12 olivine grains were recovered from heavy mineral processing and sent for microprobe analysis. When the MgO numbers for these grains are plotted against SiO_2, all 12 grains fall within the same field (MgO number >80) indicating that they are derived from mafic or kimberlitic sources (Figure 28). The regional distribution of the olivine KIM grains is shown in Figure 29. The majority of recovered olivine KIM grains are located within the southeastern part of the survey area and are coincident with G9 and G10 garnet grains and Cr-diopside grains recovered in that area.

Although the binary discriminant system used here (Morris et al. 2000) is capable of isolating olivine compositions from kimberlitic and other mafic rocks, compositional overlap is substantial (Ontario Geological Survey 2001). As a result, a new classification technique was employed utilizing a large database of olivine compositions isolated from numerous kimberlitic heavy mineral concentrates from Ontario (Ontario Geological Survey 2001). Examination of minor element concentrations from 951 olivine grains picked from Ontario kimberlite heavy mineral concentrates suggests that additional

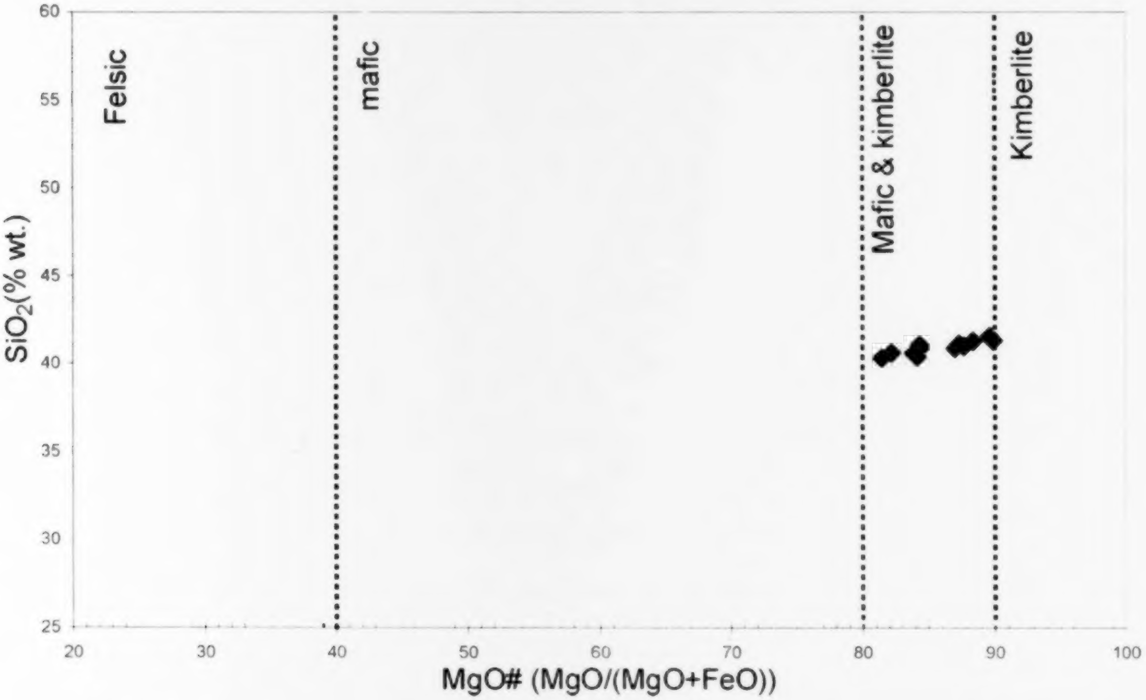

Figure 28. MgO number (MgO#) versus SiO_2 plot showing compositions of olivines recovered from the survey area.

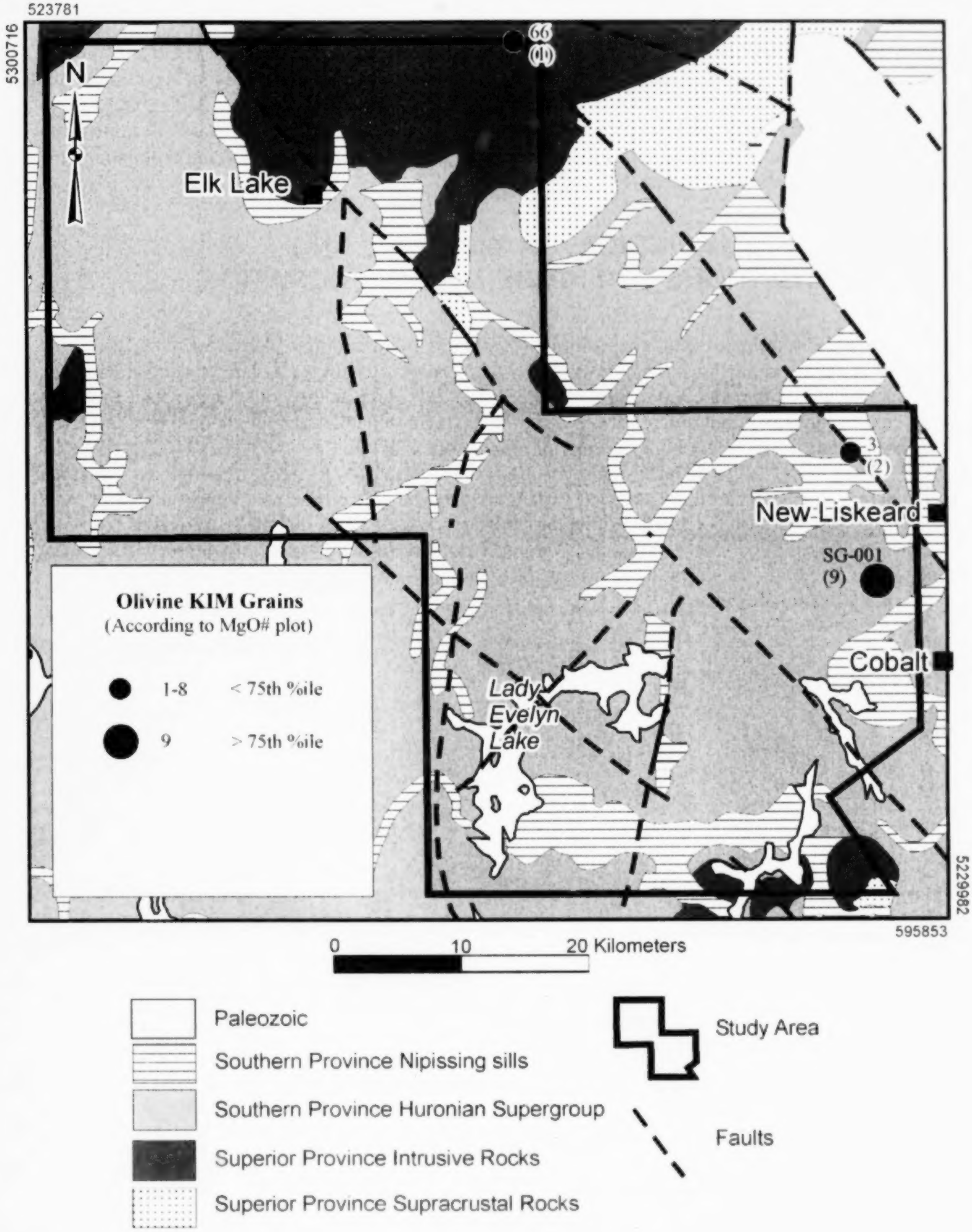
523781
5300716
66
(1)
N
Elk Lake
3
(2)
New Liskeard
SG-001
(9)
Cobalt
Lady Evelyn Lake
Olivine KIM Grains
(According to MgO# plot)
1-8 < 75th %ile
9 > 75th %ile
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 29. Regional distribution of olivine KIM grains according to MgO number (MgO#) versus SiO_2 plot (*see* Figure 28). Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

constraints may be placed on mantle-type olivine compositions crystallized at high pressures (Ontario Geological Survey 2001). The kimberlitic compositions are characterized by depleted CaO concentrations when the olivine data were plotted on a binary plot of forsterite content (Fo number versus CaO weight %; Ontario Geological Survey 2001). All 12 olivine grains recovered in this survey plot within the field defined by olivine xenocrysts from Ontario kimberlites (Figure 30). All 12 grains show depleted CaO concentrations and increased Fo numbers. Most of these grains also fall within the southeastern part of the survey area (Figure 31).

TOTAL KIMBERLITE INDICATOR MINERALS AND RECOMMENDATIONS FOR KIMBERLITE EXPLORATION

In examining the distribution and composition of kimberlite indicator minerals, several sites were identified as having anomalous numbers of KIMs. The exploration targets within the study area are based on sample sites containing a combination of significant KIMs, such as G10 and G9 garnets, Mg-ilmenites, chromites, Cr-diopsides and olivine. Sample sites with single mineral anomalies should be considered with caution unless they occur in the vicinity of other anomalous sites.

Diamond inclusion chromites and G10 garnets are considered to be the most significant KIMs and the best indicators of diamond potential. Within the study area, 4 sites—MA-003, 018, 088 and 094—each include one of these significant KIM grains. Figure 32 summarizes the distribution of these significant KIMs. Sites containing these grains are distributed within the southeastern part of the survey area.

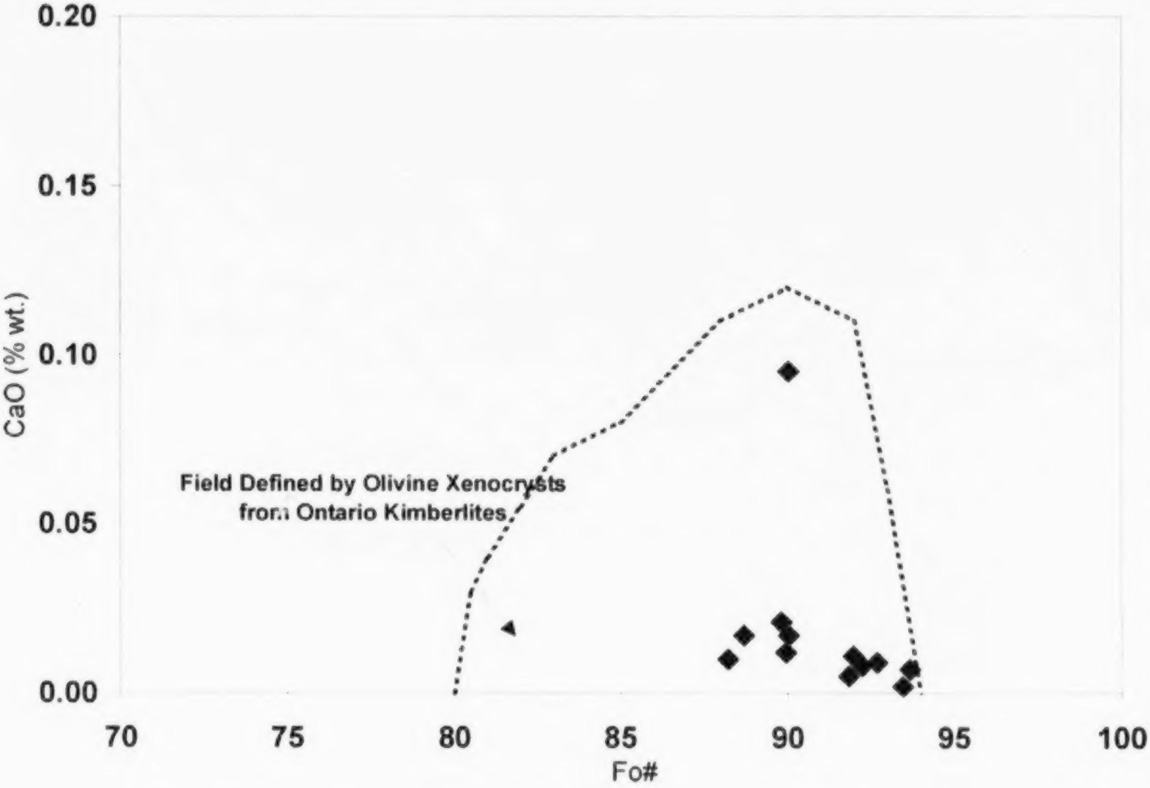

Figure 30. Forsterite content (Fo#) versus CaO plot for olivines recovered from the survey area.

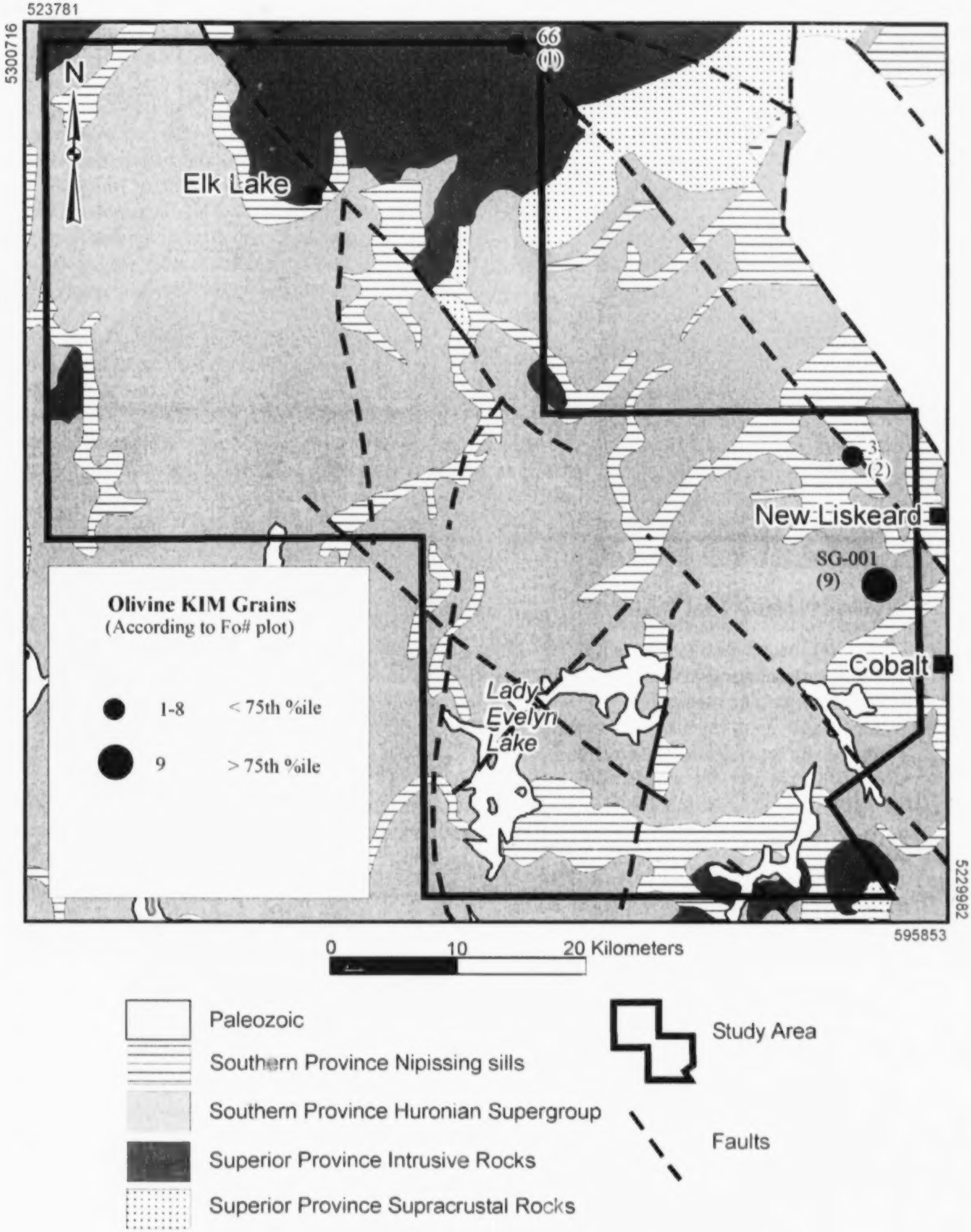
523781
5300716
N
Elk Lake
66
(1)
3
(2)
New Liskeard
SG-001
(9)
Cobalt
Lady Evelyn Lake
Olivine KIM Grains
(According to Fo# plot)
● 1-8 < 75th %ile
● 9 > 75th %ile
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 31. Regional distribution of olivine KIM grains according to forsterite content (Fo#) versus CaO plot (*see* Figure 30). Sites percentile are labelled by sample number with the corresponding number of grains shown in brackets.

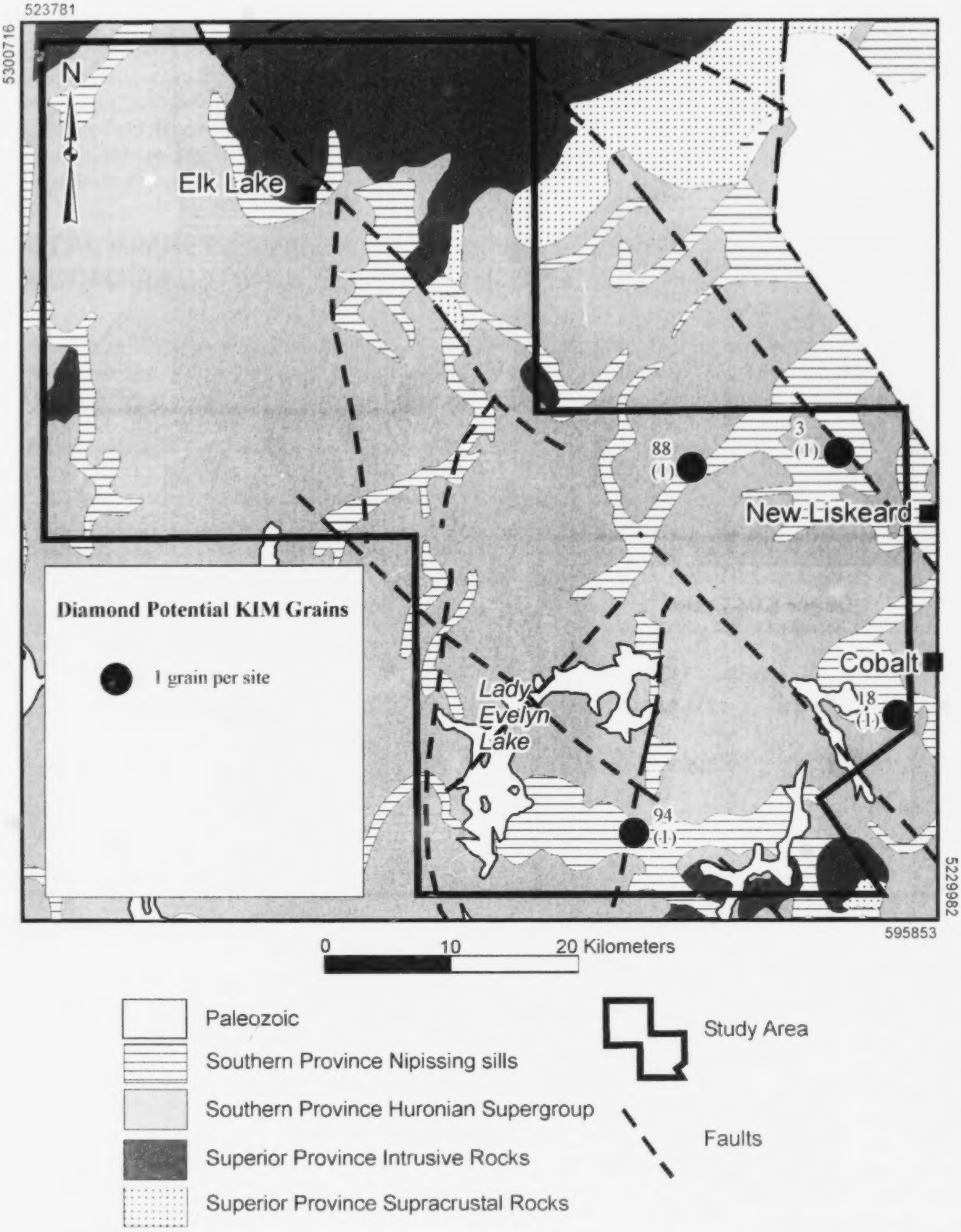
523781
5300716
N
Elk Lake
Diamond Potential KIM Grains
1 grain per site
88
(1)
3
(1)
New Liskeard
Cobalt
18
(1)
Lady Evelyn Lake
94
(1)
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 32. Regional distribution of diamond potential KIM grains (G10 garnet and diamond inclusion chromite grains). Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

To further illustrate anomalous sites, the locations of total KIMs (all garnets, chromite KIMs, ilmenite KIMs, Cr-diopside KIMs and olivine KIMs) and total possible KIMs (total KIMs including chromites of the overlap field) have been plotted (Figures 33 and 34, respectively). Anomalous sample sites that fall within the 98th percentile in Figure 33 (total KIMs) include MA-007 and 018. Anomalous sample sites that fall within the 98th percentile in Figure 34 (possible KIMs) include MA-077, 084 and 141. Anomalous sample sites that fall within the 95th percentile for total KIMs (*see* Figure 33) include MA-006, 007, 018, 025, 026 and SG-001. On the plot of possible KIMs (*see* Figure 34), 10 sites are considered anomalous (>95th percentile): MA-007, 018, 037, 050, 077, 084, 103, 141, 174 and SG-002. Between these 2 plots, 2 coincident anomalies, samples MA-007 and MA-018 occur. Sample MA-018 is considered the most significant site as it is anomalous in each of diamond potential KIM grains, total KIM grains and total possible KIM grains.

The local geology reveals the presence of Mesoproterozoic mafic intrusive rocks, more specifically the diabase dikes of the Sudbury swarm as well as the Paleoproterozoic Nipissing sills described as diabase sills and dikes and related granophyre. These intrusions may account for the observed heavy mineral signatures, however, the presence of G10 garnets and diamond inclusion chromites at some sites suggests an alternate source. The Lake Timiskaming Structural Zone faults along which these intrusives were emplaced are likely deep seated, as the rocks are mafic and sourced from depth. For this reason, these faults present viable and numerous conduits or pathways for kimberlite or related rock emplacement. Many orthogonal intersections of faults occur within the region enhancing the prospect of intrusions.

Because of its susceptibility to weathering, the presence of Cr-diopside can be used as a measure of proximity to source. This mineral disappears quickly once transported from source due to physical and chemical breakdown. Therefore, its recovery in a sample may suggest local derivation. The Al_2O_3–Na_2O–Cr_2O_3 ternary plot (*see* Figure 22) for Cr-diopside indicated that a number of grains could be classified as kimberlitic. When the locations of these grains were plotted, most anomalous sites (sites that fall within the 95th or 98th percentile) were in the southeastern part of the survey area. The anomalous sites do coincide with the distribution of other anomalous kimberlite indicator mineral sites. Sites MA-003 and 018 are coincident with diamond potential KIM grains (*see* Figure 32), site MA-006 is coincident with anomalous total KIM grains (*see* Figure 33) and site SG-002 is coincident with total possible KIM grains (*see* Figure 34). It is suggested that the source of Cr-diopside at these sites could be kimberlitic.

To further assess proximity to source, pebble lithology studies can be used. All rock types found as pebbles in the modern alluvium samples are either present within or found immediately up-ice from the study area thus providing a level of support for the assertion that transport distances are limited. Further detail regarding pebble lithology is found in the pebble data section of this report and in Appendix J.

The types of surficial deposits in the study area can provide some indication of local or distal derivation of the KIMs in the anomalies identified. Samples MA-018, 088 and 103 are close to or situated within deposits of glaciofluvial outwash. These deposits may consist of distally derived material and heavy minerals could have travelled some distance from source. Similarly, sites MA-006, 050, 077, 094, 174 and SG-002 are located near glaciofluvial ice-contact deposits and sites MA-003 and SG-001 are located near or within areas of glaciolacustrine deposits. However, surrounding these sample sites are sites which reveal anomalous KIM values in areas that do not incise glaciofluvial deposits, inferring that local derivation could be probable. If derivation of KIMs is from a kimberlite boulder located upstream, deposited in the area by glacial activity, the source, however, could be distal. Nonetheless, consistency among samples with KIM anomalies would suggest local derivation. Generally, local derivation can be inferred due to the bedrock-dominated nature of the study area.

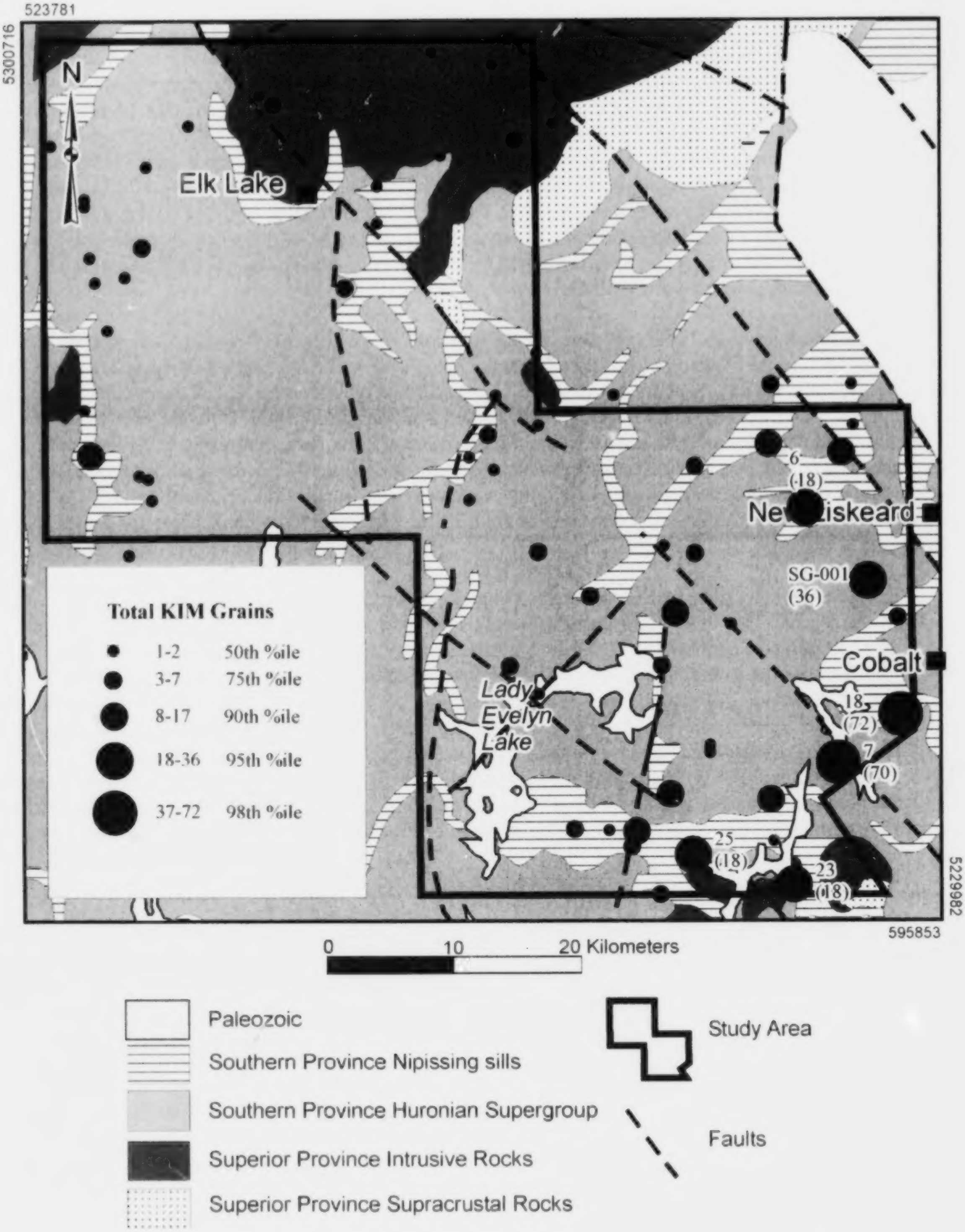
523781
5300716
N
Elk Lake
New Liskeard
Cobalt
Lady Evelyn Lake
6 (18)
SG-001 (36)
18 (72)
7 (70)
25 (18)
23 (18)
5229982
595853
Total KIM Grains
1-2 50th %ile
3-7 75th %ile
8-17 90th %ile
18-36 95th %ile
37-72 98th %ile
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 33. Regional distribution of total KIM grains (all garnets, chromite KIMs, ilmenite KIMS, Cr-diopside KIMs and olivine KIMs). Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

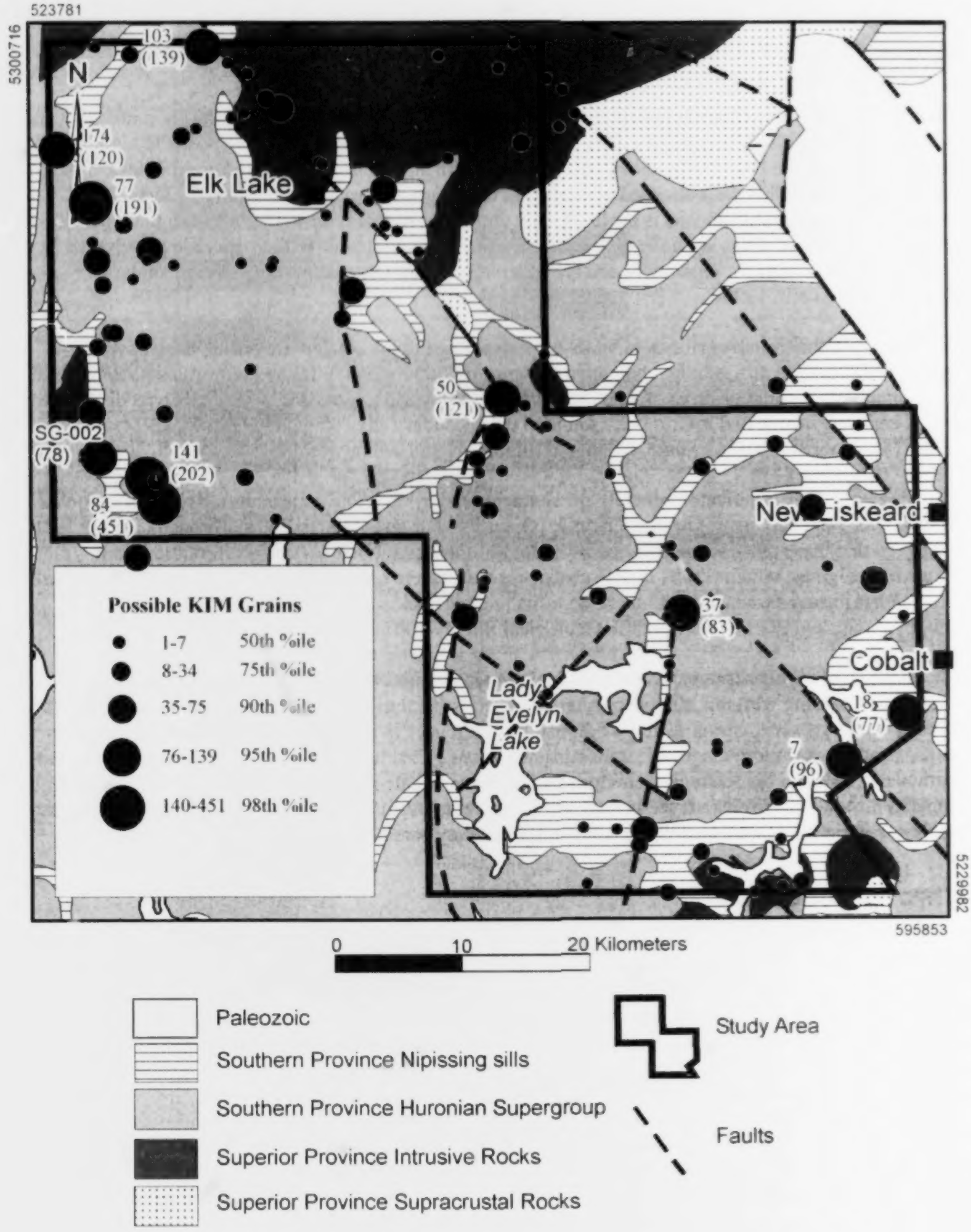
523781
5300716
595853
5229982
N
103
(139)
174
(120)
77
(191)
Elk Lake
SG-002
(78)
141
(202)
84
(451)
50
(121)
New Liskeard
37
(83)
Cobalt
Lady Evelyn Lake
18
(77)
7
(96)
Possible KIM Grains
1-7 50th %ile
8-34 75th %ile
35-75 90th %ile
76-139 95th %ile
140-451 98th %ile
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 34. Regional distribution of total possible KIM grains (includes total KIMs as well as overlap field chromites). Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

METAMORPHIC/MAGMATIC MASSIVE SULPHIDE INDICATOR MINERALS

Metamorphic/magmatic massive sulphide indicator minerals (MMSIMs) are stable heavy minerals that occur in alteration zones associated with volcanogenic massive sulphide (VMS) deposits in high-grade terrains, in magmatic Ni-Cu sulphide deposits and in skarn and greisen deposits (Averill 1999). The heavy mineral assemblages associated with each of these deposits are listed in Table 1. Identifying MMSIMs in overburden deposits is useful as they are coarse-grained, most are unique to the types of mineralization listed above, visually distinctive, easy to concentrate due to their specific gravity (>3.2), amenable to paramagnetic separation, and are relatively resistant to weathering in the secondary environment (Averill 1999).

Common mineral associations in VMS-type dispersion trains are gahnite-barite, chalcopyrite-spessartine (Mn epidote), gahnite-chalcopyrite-staurolite (or anthophyllite) and red rutile-spinel-kyanite (or sillimanite). Gahnite is probably the most important MMSIM associated with VMS-type dispersions as it is enriched in zinc and is extremely stable in the secondary environment. Other MMSIMs associated with VMS deposits include kyanite, sillimanite, staurolite and orthopyroxene.

Magmatic Ni-Cu indicator minerals are characterized by distinctive chromium-rich phases, such as Cr-diopside, chromite, uvarovite and Cr-rutile (Ontario Geological Survey 2001). Averill (1999) suggested that these phases are produced as a result of the separation of Ni-Cu-Fe-S liquids from ultramafic magmas, which results in the subsequent enrichment of Mg, Fe, Cr, Al and Si in the residual melt. Other phases associated with these deposits include chalcopyrite, forsteritic olivine, Mg-orthopyroxene and PGE alloys (Ontario Geological Survey 2001).

Many of these phases occur as common components in non-mineralized rocks, presenting a challenge in dealing with this complex group of minerals (Crabtree 2003). Averill (1999) suggested that olivine, orthopyroxene, chromite and Cr-diopside occurrences in alluvial samples should only be emphasized if other more diagnostic minerals are present. Crabtree (2003) notes that sulphides are not particularly stable in the secondary environment, however, chalcopyrite and sphalerite are nominally stable in postglacial terrains. It seems logical, therefore, to evaluate these occurrences together with more stable ore-enriched phases, such as gahnite, whenever they occur.

Chrome Diopside

Averill (1999) has suggested that low Cr-diopsides are an important indicator mineral for magmatic Ni-Cu mineralization with 2 notable examples of this association occurring at Thompson, Manitoba and Outokumpu, Finland. Clinopyroxene is one of the first minerals to crystallize from a mafic to ultramafic melt. If its formation precedes chromite, chromium in the melt may initially be incorporated into the diopside structure. However, clinopyroxene crystallization occurring after chromite can still produce Cr-diopside. The silicate melt will eventually be depleted in iron due to the formation of Ni-Cu minerals and chromite crystallization will cease, allowing any excess chromium to be included in diopside. Only those Cr-diopsides plotting outside the kimberlite field defined on a Cr_2O_3–Al_2O_3–Na_2O ternary diagram were considered as potential MMSIMs. These grains were further subdivided based on their Cr_2O_3 weight % values. Chrome diopsides with less than 1.3 weight % Cr_2O_3 were considered to be MMSIMs (Morris et al. 2000).

Table 1. List of indicator minerals found in the survey area and the associated base metal mineralization style (*after* Averill 1999). The presence of a mineral species is indicated by a shaded rectangle.

Indicator Mineral	**Metamorphosed VMS**	**Magmatic Ni-Cu**	**Skarn**	**Griesen**	**Other Occurrence**
Chalcopyrite	■	■	■	■	
Chromite		■			Mafic igneous
Corundum	■				High-grade metamorphic
Cr-rutile	■	■			
Forsteritic olivine			■		
Gahnite	■				
Grossular			■		
Kyanite	■				High-grade metamorphic
Low Cr-diopside		■			Mafic igneous
Molybdenite	■	■	■	■	
Mn-epidote	■				
Native gold	■		■		
Olivine		■			Mafic igneous
Orthopyroxene	■	■			High-grade metamorphic
Pyrite	■	■	■	■	
Sillimanite	■				High-grade metamorphic
Spessartine	■				Metavolcanic
Staurolite	■				High-grade metamorphic
Uvarovite		■			
Anthophyllite	■				High-grade metamorphic
Mg-spinel	■				High-grade metamorphic
Sapharine	■				High-grade metamorphic
Dumortierite	■				
Franklinite	■				
Willemite	■				
Barite	■				
Cinnabar	■				
Loellingite	■				
Tourmaline	■			■	
Hercynite		■			
Rammelsbergite		■			
Sperrylite		■			
Vesuvianite			■		
Johannsenite			■		
Scheelite			■		
Topaz				■	
Fluorite				■	
Cassiterite				■	
Wolframite				■	

Abbreviations: VMS: volcanosedimentary massive sulphide mineralization; Ni-Cu: nickel-copper massive sulphide mineralization.

Table 2. Summary of MMSIMs picked and anomalous MMSIM sites (see text for ranking system). Actual grain numbers are shown unless otherwise stated (i.e., %). Samples ranked 3 and 4 fall above the 95th percentile of all sites.

	Minerals 0.25 to 0.5 mm													
Sample Number (02-)	**Low Cr-diop**	**Chr**	**Cpy**	**Py**	**Ghn**	**Cr-gros**	**Cor**	**% Gth**	**% Ky**	**% Sill**	**% St**	**% Sps**	**% Fay**	**% Opx**	**Rank**
JR-MA-141	4	200	1	5	0	0	0	0.50	0.00	0.50	1.00	0.00	0.00	0.25	4
JR-MA-050	1	120	2	0	1	0	0	0.00	0.00	0.00	0.25	0.00	0.00	2.00	3
JR-MA-103	0	139	3	15	0	0	0	0.00	0.00	0.25	0.00	0.00	0.00	5.00	3

Abbreviations of MMSIM types (*also see* Appendix I): Chr, chromite; Cor, corundum; Cpy, chalcopyrite; Cr-diop, chrome diopside; Cr-gros, Cr-grossular; Fay, fayalite; Ghn, gahnite; Gth, goethite; Ky, kyanite; Opx, orthopyroxene; Py, pyrite; Sill, sillimanite; Sps, spessartine; St, staurolite.

Chromite

During fractional crystallization of mafic and ultramafic magmas, chromite is one of the earliest minerals to appear and often forms layered cumulates at the base or within the solidified melt. Chromite is a primary component of many mafic and ultramafic layered intrusions that host Ni-Cu mineralization, for example, the Bushveld Complex, South Africa; the Skaergaard intrusion, Greenland; the Stillwater Complex, Montana; and the Muskox intrusion, NWT. As well, chromite occurs in komatiitic flows that host nickel-sulphide mineralization (Kambalda, Australia; Nor'ilsk, Russia).

Those chromites that plot in the non-lamproitic–kimberlitic field and the overlap field of the Fipke et al. (1995) Cr_2O_3–TiO_2 plot were considered to be MMSIMs.

OTHER METAMORPHIC/MAGMATIC MASSIVE SULPHIDE INDICATOR MINERALS

The formation of Ni-Cu sulphide minerals removes iron from crystallizing mafic to ultramafic melts, resulting in the formation of magnesium-rich olivines and magnesium-rich orthopyroxenes. The conclusion of chromite crystallization resulting from the lack of iron allows excess chromium in the melt to be incorporated into red rutile and uvarovite (Averill 1999).

Picking results for MMSIMs were reported in 3 ways: actual grain counts (e.g., chalcopyrite or low Cr-diopside); percentages of the total fraction size (e.g., orthopyroxene); or as trace amounts (e.g., staurolite). In order to determine the distribution of sites with anomalous MMSIMs, a ranking system was designed to analyze the data in a uniform manner. Minerals present in trace amounts were assigned values representing half of the lowest reported amount, 0.25%. The sites were then ranked from 4 to 0 depending upon the number of anomalous (anomalous defined as >95th percentile) MMSIMs determined for each site. For example, sample MA-141 has the highest number (4) of different anomalous MMSIMs, (chromite, goethite, sillimanite and staurolite). Site MA-103 was given a ranking of 3 as it consisted of 3 different types of anomalous MMSIMs (chromite, chalcopyrite and pyrite). Results of this ranking system were used to produce an MMSIM proportional dot diagram summarizing the distribution of those sites with the highest number of anomalous MMSIMs. Above the 95th percentile, 3 sites ranked at 3 or 4 (Table 2) and 59 sites ranked below the 95th percentile, at 1 or 2. The regional distribution of the anomalies is shown in Figure 35.

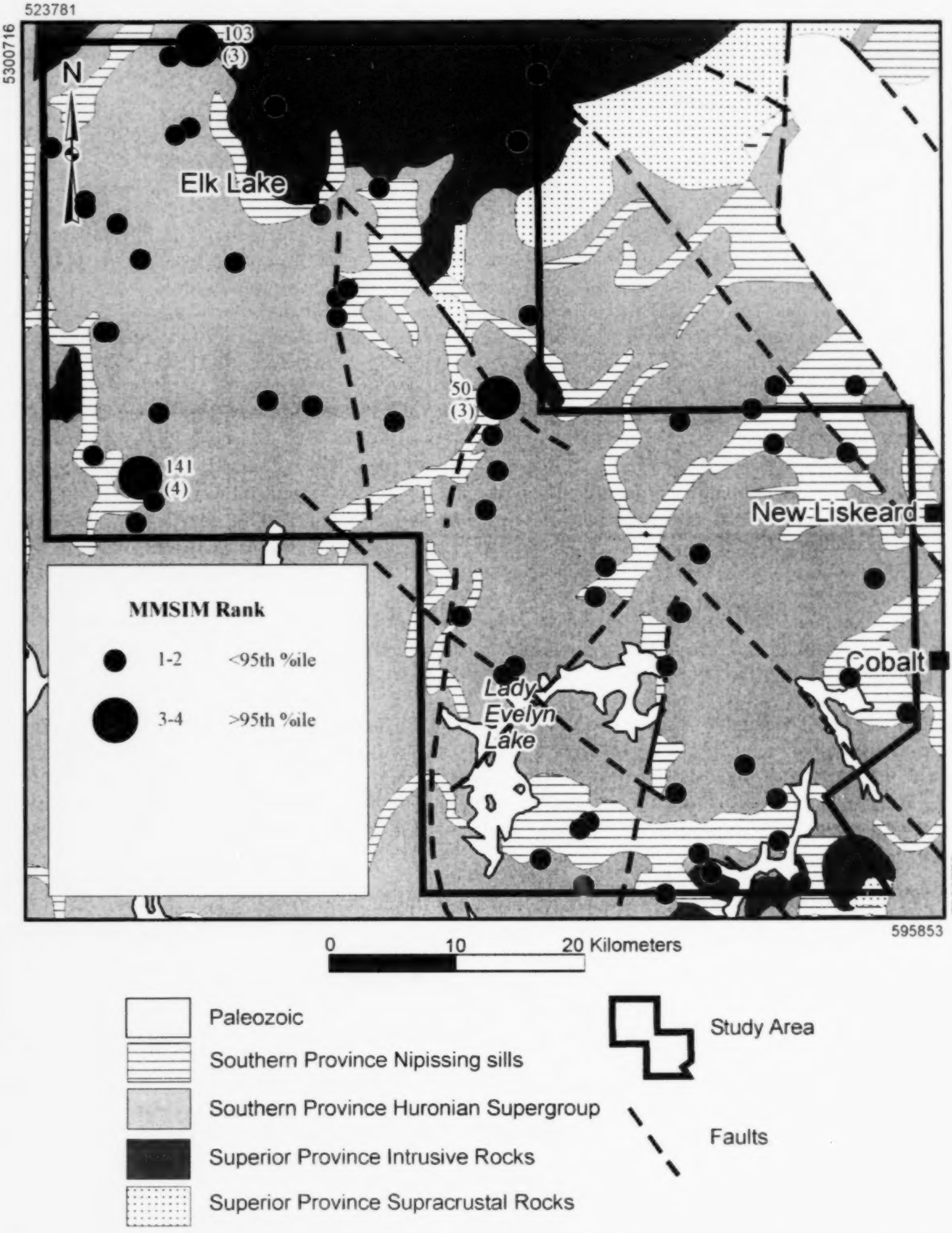
523781
5300716
N
103
(3)
Elk Lake
50
(3)
141
(4)
New Liskeard
Cobalt
Lady Evelyn Lake
MMSIM Rank
● 1-2 <95th %ile
● 3-4 >95th %ile
5229982
595853
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 35. Regional distribution of MMSIM® indicators. Anomalous sites are noted by sample number, rank of these sites is shown in brackets (ranking methodology is described in text).

Anomalous MMSIM sites are located within the northwestern part of the study area. However, sites containing MMSIMs are evenly distributed throughout the entire survey area. The MMSIM anomalies could occur in various geological environments. Polymetallic occurrences of metals including copper, cobalt, silver, gold, zinc, lead and nickel are known to be either hosted within the margins of the Nipissing diabase or within sedimentary rocks adjacent to diabase sills. The mafic and ultramafic rocks of the Nipissing diabase, Sudbury dike swarm and related intrusive rocks may have pods of magmatic Ni-Cu massive sulphides. As well, small quartz-carbonate veins containing anomalous values of Cu, Ag, Co ± Au, Ni may occur in the region. The emplacement of Archean mafic and felsic intrusive rocks or Proterozoic mafic intrusive rocks may have liberated hydrothermal fluids that remobilized metals from the metavolcanic rocks or Huronian Supergroup sediments. Consequently, these fluids could have deposited the sulphides in quartz-carbonate veins in any of the rock formations present in the vicinity as they travelled along structural contacts or fault zones. Later metamorphism could have resulted in the genesis of similar veins. Sulphide veins in rhyolites and related felsic volcanic rock types may represent zones of volcanogenic massive sulphides with minor copper and zinc mineralization (Born 1989).

GOLD

Gold grains recovered from modern alluvium samples are typically silt sized and were classified according to their grain shape. The shape varies depending on the distance of transport from their source area. The gold grain shape classification is based on DiLabio (1990) and uses the terms pristine, modified and reshaped. In general, pristine grains appear as angular wires or rods and thus retain primary textures, such as crystal faces, suggesting little distance of transport from the source. Modified grains retain the original shape, but have irregular edges and crumpled or curled protrusions. Reshaped grains indicate a longer distance of transport from source; therefore appearing flattened or rounded, retaining little or none of their original form (DiLabio 1990).

Gold grain data for the 183 samples collected are listed in Appendix F. A total of 351 gold grains were recovered, of which 49 were pristine, 66 were modified and 236 were reshaped. The majority of grains were reshaped, suggesting some distance of transport. Table 3 lists the samples that fall within the 90th, 95th and 98th percentiles and the shapes of visible gold grains. Grains were recovered from only 76 of the sites sampled. Only 8 samples were considered anomalous, 2 above the 98th percentile (16 to 88 grains) and 6 above the 95th percentile (8 to 15 grains) (Figure 36).

Anomalous gold grain sites (>95th percentile) are distributed throughout the entire survey area (*see* Figure 36). There is, however, a cluster of samples containing gold grains (including anomalous sites) worth noting. These are located along the Montreal River near the town of Elk Lake in the northern part of the survey area. A past gold producer, Consolidated Matachewan, is located upstream from these anomalies, suggesting that these grains may have been transported down river along the Montreal River from the Matachewan area. The large number of reshaped grains recovered suggests that the gold has travelled some distance from source. Gold mineralization in the Matachewan area is generally associated with quartz veins and feldspar porphyry dikes occupying shear zones or fractures within the metavolcanic rocks or epizonal intrusions (Pyke 1978). Additionally, occurrences of gold mineralization are found within the Round Lake batholith. According to Ayer and Trowell (2000), there is known gold mineralization within the felsic to intermediate intrusive rocks of the Round Lake batholith. It is possible that the anomalous gold grain sites may be related to this mineralization.

Table 3. Summary of gold grain sites.

Sample Number	Number of Visible Gold Grains				Rock Type
	Total	Reshaped	Modified	Pristine	
98th percentile					
02-JR-MA-037	88	83	0	5	Huronian Supergroup
02-JR-MA-130	57	29	13	15	felsic intrusive
95th percentile					
02-JR-MA-122	14	5	3	6	Huronian Supergroup
02-JR-MA-039	13	13	0	0	Huronian Supergroup
02-JR-MA-002	9	4	3	2	Huronian Supergroup
02-JR-MA-098	8	6	0	2	mafic intrusive
02-JR-MA-132	8	6	2	0	felsic intrusive
02-JR-MA-146	8	3	4	1	Huronian Supergroup
90th percentile					
02-JR-MA-040	6	6	0	0	Huronian Supergroup
02-JR-MA-123	6	3	2	1	mafic intrusive
02-JR-MA-128	6	3	1	2	felsic intrusive
02-JR-MA-173	6	2	2	2	Huronian Supergroup
02-JR-MA-129	5	2	2	1	felsic intrusive
02-JR-MA-141	5	2	2	1	Huronian Supergroup
02-JR-SG-005	5	2	3	0	Huronian Supergroup
02-JR-MA-091	4	3	1	0	Huronian Supergroup
02-JR-MA-124	4	1	2	1	mafic intrusive
02-JR-MA-125	4	1	1	2	mafic intrusive
02-JR-MA-127	4	2	2	0	felsic intrusive

Pebble Data

Pebbles were collected from 59 different sites throughout the study area. Most of the bedrock terrane within the survey area is made up of the Cobalt Group sediments and Nipissing diabase. The eastern portion of the northern limit of the survey area comprises the Round Lake batholith, which includes massive granodiorite to granite and foliated tonalite suite rocks. It is not surprising then, to find that, in general, the percentage of mafic intrusive and sedimentary pebbles recovered from sample sites are highest regardless of the bedrock terrane over which sediments were collected. In the few cases where metavolcanic pebbles were dominant, it is likely that they were carried southwestward into the survey area by glacier movement as mafic to intermediate and ultramafic metavolcanic rocks occur just to the northeast of the survey area. A complete summary of pebble lithology counts for sample sites is included in Appendix F.

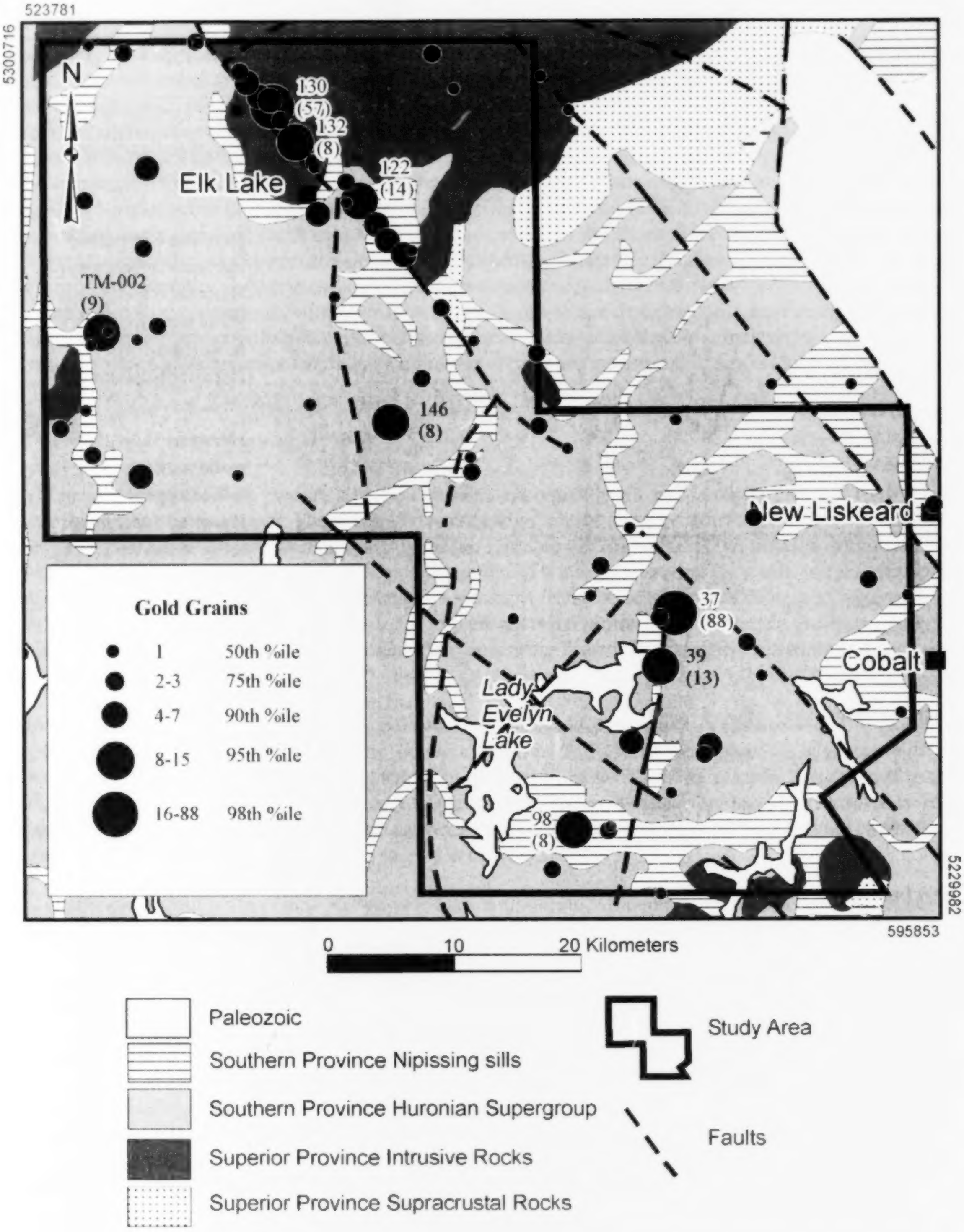
523781
5300716
N
Elk Lake
130
(57)
132
(8)
122
(14)
TM-002
(9)
146
(8)
New Liskeard
37
(88)
39
(13)
Cobalt
Lady
Evelyn
Lake
98
(8)
5229982
595853
Gold Grains
1 50th %ile
2-3 75th %ile
4-7 90th %ile
8-15 95th %ile
16-88 98th %ile
0
10
20 Kilometers
Paleozoic
Southern Province Nipissing sills
Southern Province Huronian Supergroup
Superior Province Intrusive Rocks
Superior Province Supracrustal Rocks
Study Area
Faults

Figure 36. Regional distribution of gold grains. Anomalous sites are labelled by sample number with the corresponding number of grains shown in brackets.

Conclusions

KIMBERLITES AND RELATED ROCKS

The primary objective of this survey was to create a regional data set on the types and distribution of kimberlite indicator minerals by means of modern alluvium sampling. This objective was successfully fulfilled and the results indicate that the potential for finding additional kimberlite bodies or related rock in the region is high for the following reasons: known kimberlites exist within the area; a number of important kimberlite indicator minerals were recovered; diamond potential indicators, such as G10 garnets and diamond inclusion chromites, were recovered that often occur with other KIMs; and the presence of deep-seated structures present within the area combined with the Lake Timiskaming Structural Zone which is believed to be associated with kimberlites already identified within the area. To locate the source(s) of the kimberlite heavy minerals, beyond the currently identified intrusions in the area, the sampling density needs to be increased and other exploration techniques, such as high density till sampling and the rigorous use of geophysical data need to be employed. Therefore, more detailed exploration is recommended.

BASE METAL AND GOLD

The anomalies outlined in this study may be representative of areas associated with quartz veins and feldspar porphyry dikes occupying shear zones or fractures within the metavolcanic rocks or epizonal intrusions. Also, they may be associated with the Nipissing diabase or perhaps gold mineralization identified within the Round Lake batholith. Further investigation of the identified anomalous sites may be warranted.

Acknowledgments

The author wishes to thank Cam Baker and Ross Kelly for their support and reviews of the manuscript. Peter Dejong provided valuable field assistance with sample collection. Vanessa Felix and Shannon Evers are gratefully acknowledged for their assistance.

Overburden Drilling Management performed the heavy mineral processing under contract to the OGS and Sandra Pitre of the Geoscience Laboratories in Sudbury performed the microprobe analyses.

References

Allan, S.E. 2001. Regional modern alluvium sampling survey of the Temagami–Marten River area, northeastern Ontario; Ontario Geological Survey, Open File Report 6043, 194p.

Averill, S.A. 1999. The application of heavy indicator mineralogy in mineral exploration; *in* Drift exploration in glaciated terrain, Society of Exploration Geochemists, Short Course Manual, p.117-132.

——— 2001. Processing flowsheet for gold grains, kimberlite indicators and heavy mineral suite indicators; unpublished report, Heavy Mineral Workshop, May 17, 2001, Overburden Drilling Management Ltd., 1p.

Ayer, J.A. and Trowell, N.F. 2000. Geological compilation of the Kirkland Lake area, Abitibi greenstone belt; Ontario Geological Survey, Preliminary Map P.3425, scale 1:100 000.

Barnett, P.J. 1992. Quaternary geology of Ontario; *in* Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 2, p.1011-1088.

Barnett, P.J., Henry, A.P. and Babuin, D. 1991. Quaternary geology of Ontario, east-central sheet; Ontario Geological Survey, Map 2555, scale 1:1 000 000.

Bennett, G., Dressler, B.O. and Robertson, J.A. 1991. The Huronian Supergroup and associated intrusive rocks; *in* Geology of Ontario; Ontario Geological Survey, Special Volume 4, Part 1, p.549-591.

Born, P. 1989. Precambrian geology, Cassels and Riddell townships; Ontario Geological Survey, Report 271, 73p.

Born, P. and Burbidge, G.H. 1997. Brigstocke and Kittson townships; Ontario Geological Survey, Report 275, 55p.

Crabtree, D.C. 2003. Preliminary results from the James Bay Lowland indicator mineral sampling program; Ontario Geological Survey, Open File Report 6108, 115p.

Dawson, J.B. and Stephens, W.E. 1975. Statistical classification of garnets from kimberlite and associated xenoliths; Journal of Geology, v.83, p.589-607.

DiLabio, R.N.W. 1990. Classification and interpretation of the shapes and surface textures of gold grains from till on the Canadian Shield; *in* Current Research, Part C, Geological Survey of Canada, Paper 90-1C, p.323-329.

Fipke, C.E., Gurney, J.J. and Moore, R.O. 1995. Diamond exploration techniques emphasizing indicator mineral geochemistry and Canadian examples; Geological Survey of Canada, Bulletin 423, 86p.

Griffin, W.L., Ryan, C.G., Gurney, J.J., Sobolev, N.V. and Win, T.T. 1994. Chromite macrocrysts in kimberlites and lamproites: geochemistry and origin; *in* Kimberlites, related rocks and mantle xenoliths, Companhia de Pesquisa de Recursos Minerais, Rio de Janeiro, Brazil, Special Publication 1A, p.366-377.

Gurney, J.J. 1985. A correlation between garnets and diamonds in kimberlites; *in* Kimberlite occurrence and origin: a basis for conceptual models in exploration, University of Western Australia, Geology Department and Extension Service, Perth, Australia, v.8, p.143-166.

Gurney, J.J. and Moore, R.O. 1993. Kimberlite garnet, chromite and ilmenite compositions, applications to exploration; *in* Diamonds: exploration, sampling and evaluation, Prospectors and Developers Association of Canada, Toronto, Ontario, 1993 short course proceedings, p.109-146.

Gurney, J.J. and Zweistra, P. 1995. The interpretation of the major element compositions of mantle minerals in diamond exploration; Journal of Geochemical Exploration, v.53, p.293-309.

Haggerty, S.E. and Tompkins, L.A. 1983. Redox state of Earth's upper mantle from kimberlitic ilmenites; Nature, v.303, p.295-300.

Helmstaedt, H.H. 1993. Natural diamond occurrences and tectonic setting of "primary" diamond deposits; *in* Diamonds: exploration, sampling and evaluation, Prospectors and Developers Association of Canada, Toronto, Ontario, 1993 short course proceedings, p.1-72.

Johns, G.W. 1985. Geology of the Firstbrook and parts of surrounding townships area, District of Timiskaming; Ontario Geological Survey, Report 237, 58p.

Johns, G.W. and Van Steenburgh, R. 1985. Firstbrook and parts of surrounding townships; Ontario Geological Survey, Map 2474, scale 1:31 680.

Lee, J.E. 1993. Indicator mineral techniques in a diamond exploration program at Kokong, Botswana; *in* Diamonds: exploration, sampling and evaluation, Prospectors and Developers Association of Canada, Toronto, Ontario, 1993 short course proceedings, p.213-235.

Lovell, H.L. and Frey, E.D. 1976a. Geology of the New Liskeard area, District of Timiskaming; Ontario Division of Mines, Geological Report 144, 34p.

——— 1976b. Kerns and Hudson townships, Timiskaming District; Ontario Division of Mines, Map 2300, scale 1:31 680.

——— 1976c. Harley and Dymond townships, Timiskaming District; Ontario Division of Mines, Map 2301, scale 1:31 680.

MacKean, B.E. 1968. Geology of the Elk Lake area, District of Timiskaming; Ontario Department of Mines, Geological Report 62, 62p.

McClenaghan, M.B., Kjarsgaard, B.A., Kjarsgaard, I.M., Paulen, R.C. and Stirling, J.A.R. 1999a. Mineralogy and gechemistry of the Peddie kimberlite and associated glacial sediments, Lake Timiskaming, Ontario; Geological Survey of Canada, Open File 3775, 190p.

McClenaghan, M.B., Kjarsgaard, I.M., Stirling, J.A.R., Pringle, G., Kjarsgaard, B.A. and Berger, B. 1999b. Mineralogy and geochemistry of the C14 kimberlite and associated glacial sediments, Kirkland Lake, Ontario; Geological Survey of Canada, Open File 3719, 147p.

Meyer, W.T., Theobald, Jr., P.K. and Bloom, H. 1979. Stream sediment geochemistry; *in* Geophysics and geochemistry in the search for metallic ores, Geological Survey of Canada, Economic Geology Report 31, p.411-434.

Mitchell, R.H. 1986. Kimberlites, mineralogy, geochemistry, and petrology; Plenum Press, New York, 442p.

Morris, T.F., Sage, R.P. and Ayer, J.A. 1999. Cr-diopside as an indicator of kimberlite: application to overburden studies; abstract *in* Geological Association of Canada–Mineralogical Association of Canada, Program with Abstracts, v.24, p.86.

Morris, T.F., Sage, R.P., Crabtree, D.C. and Pitre, S.A. 2000. Kimberlite, base metal, gold and carbonatite exploration targets, derived from overburden heavy mineral data, Killala Lake area, northwestern Ontario; Ontario Geological Survey, Open File Report 6013, 114p.

Ontario Geological Survey 1991. Bedrock geology of Ontario, east-central sheet; Ontario Geological Survey, Map 2543, scale 1:1 000 000.

——— 2001. Results of modern alluvium sampling; Coral Rapids area, northeastern Ontario: Operation Treasure Hunt – Kapuskasing Structural Zone; Ontario Geological Survey, Open File Report 6068, 117p.

Pyke, D.R. 1978. Geology of the Peterlong Lake area, districts of Timiskaming and Sudbury; Ontario Geological Survey Report 171, 53p.

Reid, J.L. 2002. Regional modern alluvium sampling survey of the Mattawa–Cobalt corridor, northeastern Ontario; Ontario Geological Survey, Open File Report 6088, 235p.

Roed, M.A. 1979a. Elk Lake area (NTS 41P/NE), District of Timiskaming; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 83, 18p.

——— 1979b. New Liskeard area (NTS 31M/NW), District of Timiskaming; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 84, 28p.

——— 1979c. Maple Mountain area (NTS 41P/SE), districts of Nipissing, Sudbury and Timiskaming; Ontario Geological Survey, Northern Ontario Engineering Geology Terrain Study 89, 16p.

Roed, M.A. and Hallett, D.R. 1979a. Northern Ontario Engineering Geology Terrain Study, data base map, Elk Lake; Ontario Geological Survey, Map 5020, scale 1:100 000.

——— 1979b. Northern Ontario Engineering Geology Terrain Study, data base map, New Liskeard; Ontario Geological Survey, Map 5021, scale 1:100 000.

——— 1979c. Northern Ontario Engineering Geology Terrain Study, data base map, Maple Mountain; Ontario Geological Survey, Map 5023, scale 1:100 000.

——— 1979d. Northern Ontario Engineering Geology Terrain Study, sand and gravel resources map, New Liskeard; Ontario Geological Survey, Map 5025, scale 1:100 000.

Sage, R.P. 1996. Kimberlites of the Lake Timiskaming Structural Zone; Ontario Geological Survey, Open File Report 5937, 435p.

Schulze, D.J. 1999. The significance of eclogite and Cr-poor megacryst garnets in diamond exploration; Exploration and Mining Geology, v.6, p.349-366.

Stephenson, D.M., Morris, T.F. and Crabtree, D.C. 1999. Kimberlite, base metal and gold exploration targets based upon heavy mineral data derived from surface materials, Opasatika Lake area, northeastern Ontario; Ontario Geological Survey, Open File Report 5982, 66p.

Stone, D. 2001. A study of indicator minerals for kimberlite, base metals and gold: northern Superior Province of Ontario; Ontario Geological Survey, Open File Report 6066, 140p.

Veillette, J.J. 1986. Former southwesterly ice flows in the Abitibi–Timiskaming region: implications for the configuration of the Late Wisconsinan ice sheet; Canadian Journal of Earth Sciences, v.23, p.1724-1741.

Appendix A

Sample Site Locations

UTM co-ordinates in North American Datum 1983 (NAD 83), Zone 17

Appendix A. Sample Site Locations

SAMPLE NUMBER	UTM	
	EASTING	NORTHING
02-JR-MA-001	595591	5262386
02-JR-MA-002	592439	5262420
02-JR-MA-002	588255	5266670
02-JR-MA-004	589182	5268657
02-JR-MA-005	593473	5269605
02-JR-MA-006	585521	5262327
02-JR-MA-007	587981	5242261
02-JR-MA-008	588374	5248942
02-JR-MA-009	586035	5249702
02-JR-MA-010	581935	5249085
02-JR-MA-011	578567	5255509
02-JR-MA-012	579571	5253052
02-JR-MA-013	580757	5251707
02-JR-MA-014	586594	5257521
02-JR-MA-015	590355	5256730
02-JR-MA-016	583942	5239753
02-JR-MA-017	582689	5239447
02-JR-MA-018	592947	5246116
02-JR-MA-019	585843	5251593
02-JR-MA-020	592615	5253592
02-JR-MA-021	593412	5255317
02-JR-MA-022	582926	5236041
02-JR-MA-023	584488	5232635
02-JR-MA-024	582981	5232265
02-JR-MA-025	576593	5235071
02-JR-MA-026	577536	5233535
02-JR-MA-027	580786	5231893
02-JR-MA-028	589018	5271923
02-JR-MA-029	582682	5271853
02-JR-MA-020	576756	5258665
02-JR-MA-021	574705	5259573
02-JR-MA-022	574256	5259242
02-JR-MA-023	573415	5261071
02-JR-MA-024	571517	5260674
02-JR-MA-025	568414	5263147
02-JR-MA-026	568260	5264702
02-JR-MA-027	575233	5254001
02-JR-MA-028	573995	5253694
02-JR-MA-029	574017	5249875
02-JR-MA-040	571670	5243793
02-JR-MA-041	570270	5271126
02-JR-MA-042	564358	5274369
02-JR-MA-043	563415	5277511
02-JR-MA-044	556359	5280111
02-JR-MA-045	552774	5284229
02-JR-MA-046	554403	5282533
02-JR-MA-047	569498	5264965
02-JR-MA-048	566704	5266897
02-JR-MA-049	564453	5268712

SAMPLE NUMBER	UTM	
	EASTING	NORTHING
02-JR-MA-050	561082	5271023
02-JR-MA-051	562833	5270401
02-JR-MA-052	580918	5270117
02-JR-MA-053	582512	5267349
02-JR-MA-054	582180	5265239
02-JR-MA-055	567124	5250592
02-JR-MA-056	564447	5247580
02-JR-MA-057	562197	5249876
02-JR-MA-058	561349	5249094
02-JR-MA-059	540491	5281684
02-JR-MA-060	542849	5281388
02-JR-MA-061	542987	5281846
02-JR-MA-062	549288	5272522
02-JR-MA-063	548396	5277322
02-JR-MA-064	548407	5278901
02-JR-MA-065	549174	5279650
02-JR-MA-066	562070	5299042
02-JR-MA-067	562939	5298375
02-JR-MA-068	566810	5293469
02-JR-MA-069	565877	5295372
02-JR-MA-070	564511	5296131
02-JR-MA-071	564198	5296491
02-JR-MA-072	565557	5292352
02-JR-MA-073	562560	5291099
02-JR-MA-074	558398	5295111
02-JR-MA-075	556748	5289953
02-JR-MA-076	551759	5287502
02-JR-MA-077	528733	5286573
02-JR-MA-078	528769	5286065
02-JR-MA-079	528772	5283360
02-JR-MA-080	529196	5281919
02-JR-MA-081	529559	5279936
02-JR-MA-082	531959	5280468
02-JR-MA-083	532217	5258518
02-JR-MA-084	534082	5262858
02-JR-MA-085	526790	5268542
02-JR-MA-086	535111	5281601
02-JR-MA-087	534378	5276673
02-JR-MA-088	576751	5265528
02-JR-MA-089	581324	5261017
02-JR-MA-090	581360	5261424
02-JR-MA-091	577885	5243530
02-JR-MA-092	577832	5243061
02-JR-MA-093	577461	5242863
02-JR-MA-094	572172	5236950
02-JR-MA-095	571680	5235669
02-JR-MA-096	564118	5234644
02-JR-MA-097	567934	5237521
02-JR-MA-098	567231	5236970

Appendix A. Sample Site Locations

SAMPLE NUMBER	UTM	
	EASTING	NORTHING
02-JR-MA-099	570019	5237195
02-JR-MA-100	569944	5236824
02-JR-MA-101	568459	5255286
02-JR-MA-102	537504	5299031
02-JR-MA-102	537608	5298873
02-JR-MA-104	539475	5297423
02-JR-MA-105	539691	5293174
02-JR-MA-106	546873	5289010
02-JR-MA-107	562350	5253557
02-JR-MA-108	562483	5253198
02-JR-MA-109	557967	5253817
02-JR-MA-110	559365	5256065
02-JR-MA-111	559509	5256519
02-JR-MA-112	564374	5258846
02-JR-MA-113	563580	5257013
02-JR-MA-114	560914	5265193
02-JR-MA-115	559134	5265048
02-JR-MA-116	558949	5262813
02-JR-MA-117	554702	5262338
02-JR-MA-118	559225	5275347
02-JR-MA-119	556828	5278096
02-JR-MA-120	549383	5287891
02-JR-MA-121	549332	5286284
02-JR-MA-122	550446	5286564
02-JR-MA-123	551786	5284545
02-JR-MA-124	552629	5283375
02-JR-MA-125	553812	5282247
02-JR-MA-126	541045	5296578
02-JR-MA-127	541548	5295723
02-JR-MA-128	542522	5294608
02-JR-MA-129	543320	5294365
02-JR-MA-130	543586	5293995
02-JR-MA-131	544258	5292817
02-JR-MA-132	545459	5291157
02-JR-MA-133	546539	5289584
02-JR-MA-134	546842	5289471
02-JR-MA-135	540760	5293503
02-JR-MA-136	535373	5297901
02-JR-MA-137	556127	5297988
02-JR-MA-138	557702	5295217
02-JR-MA-139	560866	5297023
02-JR-MA-140	533734	5264563
02-JR-MA-141	533006	5264779
02-JR-MA-142	532819	5275522
02-JR-MA-143	531268	5284696
02-JR-MA-144	533347	5282782
02-JR-MA-145	533013	5281889
02-JR-MA-146	552803	5269133
02-JR-MA-147	536965	5292287
02-JR-MA-148	535832	5291701
02-JR-MA-149	531728	5298090

SAMPLE NUMBER	UTM	
	EASTING	NORTHING
02-JR-MA-150	528897	5298697
02-JR-MA-151	529032	5298703
02-JR-MA-152	560482	5268041
02-JR-MA-153	559057	5266248
02-JR-MA-154	550245	5270382
02-JR-MA-155	565356	5233851
02-JR-MA-156	567481	5232494
02-JR-MA-157	573866	5231795
02-JR-MA-158	580456	5237779
02-JR-MA-159	580260	5242011
02-JR-MA-160	574791	5239881
02-JR-MA-161	565114	5241884
02-JR-MA-162	569474	5253257
02-JR-MA-163	569323	5257636
02-JR-MA-164	575128	5269144
02-JR-MA-165	560016	5262147
02-JR-MA-166	548284	5261325
02-JR-MA-167	543122	5261407
02-JR-MA-168	540733	5264763
02-JR-MA-169	541099	5273243
02-JR-MA-170	542968	5270832
02-JR-MA-171	546405	5270389
02-JR-MA-172	555244	5272522
02-JR-MA-173	533629	5289075
02-JR-MA-174	526079	5290675
02-JR-MA-175	534415	5269829
02-JR-SG-001	590387	5256537
02-JR-SG-002	529306	5266481
02-JR-SG-002	528707	5269994
02-JR-SG-004	529152	5275124
02-JR-SG-005	547195	5285471
02-JR-SG-006	532587	5261111
02-JR-TM-001	530600	5276262
02-JR-TM-002	530153	5276222

Appendix C

Summary of Kimberlite Indicator Mineral Counts

Summary List of Abbreviations

KIM	Kimberlite Indicator Minerals
Diop	Diopside
GP	Pyrope Garnet
GO	Eclogitic Garnet
DC	Chrome Diopside
IM	Ilmenite
CR	Chromite
FO	Forsteritic Olivine
(p)	Amount of grains picked from the sample
(e)	Amount of grains estimated to be in sample

Appendix C. KIM Counts

Sample Number	Selected PseudoKIMs			KIM Count																			Total KIMs
	1.0-2.0 mm	0.5-1.0 mm	0.25-0.5 mm	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm							
	Low-Cr diopside	Low-Cr diopside	Low-Cr diopside	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM (p)	IM (e)	CR (p)	CR (e)	FO	
JR-MA-001	No Sample	0	3	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-002	No Sample	0	2	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-003	0	0	18	0	0	0	0	0	0	0	0	0	0	0	1	4	2	2	4	0	2	0	2	17
JR-MA-004	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	3
JR-MA-005	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-006	0	1	8	0	0	0	0	0	0	1	0	0	4	0	0	6	0	1	3	0	19	0	0	34
JR-MA-007	0	0	0	0	0	0	0	0	0	0	1	0	21	1	0	2	1	0	34	50	21	0	0	97
JR-MA-008	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-010	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-012	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
JR-MA-013	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-014	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-015	0	1	3	0	0	0	0	0	0	0	0	0	3	0	0	0	1	1	11	0	5	0	0	21
JR-MA-016	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-017	0	0	6	0	0	0	0	0	0	0	0	0	1	0	0	5	1	1	5	0	12	0	0	25
JR-MA-018	0	0	27	0	0	0	0	0	0	3	1	0	0	0	0	24	6	1	44	0	7	0	0	86
JR-MA-019	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-020	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	2	0	2	0	0	0	0	5
JR-MA-021	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-022	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5	0	2	0	0	8
JR-MA-023	0	0	1	0	0	0	0	0	0	2	0	0	2	0	0	2	2	1	12	0	7	0	0	28
JR-MA-024	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	0	0	0	0	5
JR-MA-025	0	0	9	0	0	0	0	0	0	1	0	1	0	0	0	5	7	2	2	0	15	0	0	33
JR-MA-026	0	0	11	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	4	0	0	8
JR-MA-027	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	4	0	0	5
JR-MA-028	No Sample	0	5	No Sample						0	0	0	0	0	0	1	1	0	0	0	1	0	0	3
JR-MA-029	0	2	10	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	2	0	1	0	0	7
JR-MA-030	0	0	2	0	0	0	0	0	0	1	0	0	2	0	0	0	0	0	1	0	7	0	0	11
JR-MA-031	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
JR-MA-033	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0

Appendix C. KIM Counts

Sample Number	Selected PseudoKIMs			KIM Count																				Total KIMs
	1.0-2.0 mm	0.5-1.0 mm	0.25-0.5 mm	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm								
	Low-Cr diopside	Low-Cr diopside	Low-Cr diopside	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM (p)	IM (e)	CR (p)	CR (e)	FO	
JR-MA-034	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-035	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-036	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-037	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	5	0	0	1	0	53	75	0	82
JR-MA-038	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-039	0	0	13	0	0	0	0	0	0	0	0	1	0	0	0	2	2	0	0	0	1	0	0	6
JR-MA-040	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-041	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
JR-MA-042	No Sample	0	1	No Sample						0	0	0	0	0	0	0	1	0	0	0	4	0	0	5
JR-MA-043	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-044	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-045	No Sample	0	1	No Sample						0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
JR-MA-046	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8
JR-MA-047	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
JR-MA-048	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-049	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-050	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	40	120	0	123
JR-MA-051	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
JR-MA-052	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-053	No Sample	0	6	No Sample						0	0	0	0	0	0	2	2	2	0	0	0	0	0	6
JR-MA-054	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-055	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-056	No Sample	No Sample	5	No Sample						No Sample						0	0	0	0	0	1	0	0	1
JR-MA-057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	3	0	0	0	0	4
JR-MA-058	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-059	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-060	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-061	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
JR-MA-062	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-063	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	14
JR-MA-064	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-065	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	21	60	0	61
JR-MA-066	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	1	1

Appendix C. KIM Counts

Sample Number	Selected PseudoKIMs			KIM Count																				Total KIMs
	1.0-2.0 mm	0.5-1.0 mm	0.25-0.5 mm	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm								
	Low-Cr diopside	Low-Cr diopside	Low-Cr diopside	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM (p)	IM (e)	CR (p)	CR (e)	FO	
JR-MA-067	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-068	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
JR-MA-069	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-070	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
JR-MA-071	No Sample	0	1	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-072	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	7	0	1	9
JR-MA-073	0	0	9	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	25	0	0	26
JR-MA-074	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-075	No Sample	0	1	No Sample						0	0	0	0	0	0	0	0	1	0	0	0	0	0	1
JR-MA-076	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	50	0	50
JR-MA-077	0	0	5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	21	200	0	203
JR-MA-078	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	21	50	0	51
JR-MA-079	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-080	0	0	6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	20	60	0	61
JR-MA-081	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	12
JR-MA-082	No Sample	0	1	No Sample						0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-083	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	20	50	0	51
JR-MA-084	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	30	500	0	501
JR-MA-085	No Sample	0	3	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-086	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
JR-MA-087	No Sample	0	1	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-088	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	9	0	0	11
JR-MA-089	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-090	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-091	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
JR-MA-092	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1
JR-MA-093	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-094	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	7	0	28	40	0	52
JR-MA-095	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	2	0	27	0	0	32
JR-MA-096	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-097	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-098	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	2	0	0	4
JR-MA-099	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0

Appendix C. KIM Counts

Sample Number	Selected PseudoKIMs			KIM Count																			Total KIMs
	1.0-2.0 mm	0.5-1.0 mm	0.25-0.5 mm	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm							
	Low-Cr diopside	Low-Cr diopside	Low-Cr diopside	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM (p)	IM (e)	CR (p)	CR (e)	FO	
JR-MA-100	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-101	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	13	0	0	16
JR-MA-102	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	4	0	0	6
JR-MA-103	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	25	120	0	124
JR-MA-104	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	5	0	0	6
JR-MA-105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
JR-MA-106	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-107	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	7
JR-MA-108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-109	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	80	0	80
JR-MA-110	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
JR-MA-111	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
JR-MA-112	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	7	0	0	9
JR-MA-113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-114	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	3
JR-MA-115	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
JR-MA-116	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3
JR-MA-117	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-119	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-120	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-121	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-122	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-123	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
JR-MA-124	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-125	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-126	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-127	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-128	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	50	0	50
JR-MA-129	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-130	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	30	50	0	51
JR-MA-131	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-132	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix C. KIM Counts

Sample Number	Selected PseudoKIMs			KIM Count																				Total KIMs
	1.0-2.0 mm	0.5-1.0 mm	0.25-0.5 mm	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm								
	Low-Cr diopside	Low-Cr diopside	Low-Cr diopside	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM (p)	IM (e)	CR (p)	CR (e)	FO	
JR-MA-133	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5
JR-MA-134	No Sample	0	3	No Sample						0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-135	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
JR-MA-136	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-137	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
JR-MA-138	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-139	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1
JR-MA-140	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	25	0	0	25
JR-MA-141	0	0	3	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	30	200	0	206
JR-MA-142	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	0	0	18
JR-MA-143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0	10
JR-MA-144	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	40	0	40
JR-MA-145	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8
JR-MA-146	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-147	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-148	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0	0	34
JR-MA-149	0	1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	14
JR-MA-150	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5
JR-MA-151	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-152	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	3	0	0	0	0	57	0	1	62
JR-MA-153	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	11
JR-MA-154	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-155	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-156	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-157	0	5	36	0	0	0	0	0	0	1	1	0	0	0	0	2	4	0	0	0	4	0	0	12
JR-MA-158	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-159	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-160	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	2	0	6	0	0	14
JR-MA-161	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-162	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-163	No Sample	No Sample	0	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-164	No Sample	No Sample	1	No Sample						No Sample						0	0	0	0	0	0	0	0	0
JR-MA-165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	11

Appendix C. KIM Counts

Sample Number	Selected PseudoKIMs			KIM Count																				
	1.0-2.0 mm	0.5-1.0 mm	0.25-0.5 mm	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm								Total KIMs
	Low-Cr diopside	Low-Cr diopside	Low-Cr diopside	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM (p)	IM (e)	CR (p)	CR (e)	FO	
JR-MA-166	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-167	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	6
JR-MA-168	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	11	0	0	11
JR-MA-169	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
JR-MA-170	No Sample	0	0	No Sample						0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-171	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-172	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	14
JR-MA-174	0	0	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	60	120	0	121
JR-MA-175	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0	0	12
JR-SG-001	0	0	8	0	0	0	0	0	0	1	0	0	1	1	6	4	1	1	12	0	6	0	3	36
JR-SG-002	0	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	1	0	30	75	0	79
JR-SG-003	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	50	0	50
JR-SG-004	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	16	0	0	16
JR-SG-005	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
JR-SG-006	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-TM-001	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	0	0	14
JR-TM-002	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	20	40	0	41

Appendix E

Summary of Microprobe Data for Indicator Minerals

Elemental Symbols

Na	Sodium	Ni	Nickel
Mg	Magnesium	Nb	Niobium
Al	Aluminum	V	Vanadium
Si	Silicon	Zn	Zinc
Cr	Chromium	O	Oxygen
Mn	Manganese	Ca	Calcium
Ti	Titanium	K	Potassium
Fe	Iron		

Appendix E. Garnets

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
GARNETS											
G10											
JR-MA-003-004	40.675	0.015	21.143	3.183	18.846	2.853	0.471	12.378	0.003	0.000	99.567
JR-MA-018-012	41.342	0.000	21.922	2.955	21.050	3.665	0.638	8.240	0.023	0.000	99.835
JR-MA-094-004	41.781	0.088	17.801	7.851	20.803	5.117	0.373	6.492	0.016	0.000	100.322
G9											
JR-MA-026-001	40.683	0.178	17.893	7.637	19.151	6.418	0.440	7.373	0.021	0.000	99.794
JR-MA-025-003	40.773	0.268	17.774	7.573	19.786	6.029	0.438	7.270	0.041	0.002	99.954
JR-MA-003-003	41.234	0.554	18.238	7.070	21.583	5.250	0.295	5.686	0.035	0.004	99.949
JR-MA-006-004	40.816	0.093	18.889	6.647	19.970	6.177	0.395	6.616	0.007	0.000	99.610
JR-MA-023-001	40.918	0.264	18.530	6.624	20.300	5.868	0.334	6.949	0.026	0.000	99.813
JR-MA-023-007	40.488	0.242	19.115	6.276	19.690	5.522	0.421	7.675	0.033	0.002	99.464
JR-MA-017-002	40.594	0.169	18.789	6.268	19.397	5.633	0.473	8.129	0.042	0.001	99.495
JR-MA-004-001	40.681	0.000	19.362	6.106	18.520	6.982	0.512	7.730	0.010	0.000	99.903
JR-MA-088-001	40.744	0.185	18.739	6.084	20.178	5.894	0.299	6.945	0.012	0.000	99.080
JR-MA-018-015	40.157	0.079	18.716	6.039	16.547	7.160	0.628	10.600	0.019	0.000	99.945
JR-MA-018-007	40.818	0.186	19.337	5.929	20.591	5.407	0.361	6.653	0.022	0.000	99.304
JR-MA-025-001	40.441	0.225	19.106	5.910	19.539	5.925	0.471	7.974	0.033	0.000	99.624
JR-MA-018-018	41.386	0.000	19.728	5.740	19.551	5.915	0.501	7.518	0.014	0.000	100.353
JR-MA-018-004	40.628	0.050	19.666	5.701	19.611	5.643	0.518	7.770	0.013	0.000	99.600
JR-MA-018-036	41.258	0.146	20.122	5.688	19.927	5.539	0.489	7.796	0.040	0.004	101.009
JR-MA-017-004	40.355	0.032	19.298	5.669	17.523	6.559	0.464	9.799	0.015	0.000	99.714
JR-MA-007-001	41.079	0.179	19.538	5.665	20.038	5.507	0.480	7.452	0.024	0.001	99.963
JR-MA-029-002	40.958	0.006	19.655	5.646	18.916	6.584	0.518	7.597	0.004	0.000	99.884
JR-MA-003-001	41.300	0.078	19.909	5.567	20.030	5.503	0.479	7.349	0.020	0.001	100.236
JR-MA-018-038	41.454	0.502	19.451	5.420	21.458	5.279	0.305	6.382	0.063	0.003	100.317
JR-MA-039-002	40.844	0.176	19.404	5.378	19.946	5.549	0.411	7.528	0.031	0.000	99.267
JR-MA-017-003	40.988	0.218	19.773	5.239	20.307	5.051	0.427	7.751	0.051	0.000	99.805
JR-MA-018-002	41.340	0.506	19.604	5.184	21.153	4.970	0.319	6.698	0.053	0.001	99.828
JR-MA-057-001	41.295	0.021	20.447	4.867	20.550	5.285	0.401	7.236	0.024	0.000	100.126
JR-MA-020-001	41.285	0.206	20.222	4.832	21.019	5.220	0.376	6.680	0.030	0.003	99.873
JR-MA-037-005	41.325	0.041	20.498	4.824	20.677	4.761	0.459	7.459	0.021	0.003	100.068
JR-MA-053-002	40.651	0.040	20.215	4.759	19.846	5.599	0.459	7.493	0.019	0.000	99.081
JR-MA-023-002	41.078	0.148	20.150	4.681	19.415	4.932	0.452	9.207	0.032	0.000	100.095

Appendix E. Garnets

Sample	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	MnO	FeO	Na_2O	K_2O	Total
JR-MA-037-008	41.350	0.025	20.590	4.681	19.800	5.519	0.499	7.798	0.021	0.000	100.283
JR-MA-039-001	41.280	0.013	20.478	4.679	19.643	5.163	0.503	8.000	0.007	0.000	99.766
JR-MA-006-006	41.576	0.105	20.524	4.658	20.144	5.055	0.487	7.607	0.021	0.000	100.177
JR-MA-023-006	41.346	0.480	19.721	4.644	20.812	5.253	0.311	7.526	0.037	0.000	100.130
JR-MA-029-003	41.285	0.089	20.558	4.642	20.285	5.281	0.504	7.150	0.022	0.001	99.817
JR-MA-072-001	41.158	0.189	20.501	4.621	20.612	5.032	0.442	7.574	0.036	0.000	100.165
JR-MA-017-005	41.544	0.132	20.653	4.557	19.799	5.462	0.572	8.080	0.021	0.000	100.820
JR-MA-026-002	40.949	0.049	20.491	4.530	19.767	5.695	0.432	8.053	0.006	0.000	99.972
JR-MA-037-002	41.146	0.020	20.582	4.502	19.833	5.227	0.494	7.970	0.008	0.001	99.783
JR-MA-041-001	41.415	0.042	20.695	4.480	20.263	4.765	0.513	7.729	0.012	0.000	99.914
JR-MA-018-008	41.033	0.094	20.247	4.468	20.149	5.269	0.394	7.696	0.011	0.000	99.361
JR-MA-028-001	41.270	0.017	20.640	4.425	20.394	5.251	0.508	7.468	0.013	0.001	99.987
JR-MA-025-004	40.952	0.201	20.257	4.376	20.107	5.190	0.433	7.756	0.043	0.000	99.315
JR-MA-029-001	40.795	0.010	20.951	4.308	20.471	4.875	0.497	7.284	0.003	0.002	99.196
JR-MA-006-003	41.398	0.006	21.005	4.279	20.267	5.136	0.450	7.530	0.011	0.000	100.082
JR-MA-029-004	41.502	0.103	20.782	4.240	20.357	5.328	0.519	7.907	0.027	0.000	100.765
JR-MA-025-005	41.155	0.054	20.732	4.194	20.285	5.213	0.591	7.536	0.026	0.000	99.786
JR-MA-017-001	40.697	0.885	19.746	4.190	20.372	5.600	0.317	7.894	0.046	0.004	99.751
JR-MA-030-002	41.434	0.664	20.467	4.185	21.882	4.926	0.313	6.299	0.058	0.000	100.228
JR-MA-025-015	41.444	0.012	20.978	4.151	21.122	4.819	0.382	7.307	0.003	0.000	100.218
JR-MA-018-014	41.406	0.000	21.072	4.137	20.489	4.740	0.471	7.295	0.014	0.000	99.624
JR-MA-070-001	41.024	0.055	20.910	3.929	20.253	5.100	0.489	7.685	0.021	0.000	99.466
JR-MA-037-004	40.800	0.069	21.133	3.690	19.633	5.607	0.481	8.102	0.023	0.000	99.538
JR-MA-037-001	41.500	0.222	20.882	3.685	21.465	4.794	0.288	6.788	0.025	0.000	99.649
JR-MA-018-003	40.864	0.019	21.153	3.679	19.616	5.331	0.514	8.233	0.015	0.000	99.424
JR-MA-006-012	40.805	0.010	21.502	3.555	19.481	5.299	0.554	8.587	0.027	0.000	99.820
JR-MA-018-024	41.253	0.019	21.375	3.281	19.758	5.052	0.482	8.607	0.018	0.000	99.845
JR-MA-007-002	41.190	0.166	21.192	3.234	19.585	5.426	0.481	8.378	0.018	0.003	99.673
JR-MA-018-022	41.561	0.000	21.601	3.092	19.088	5.751	0.638	8.459	0.005	0.000	100.195
JR-MA-018-021	40.570	0.017	21.484	3.083	19.213	5.539	0.635	8.377	0.011	0.003	98.932
JR-MA-003-002	41.424	0.275	21.401	2.992	21.410	4.798	0.283	6.950	0.020	0.005	99.558
JR-MA-053-001	41.599	0.022	21.719	2.983	19.030	5.626	0.633	9.002	0.012	0.000	100.626
JR-MA-006-005	41.244	0.017	21.789	2.879	19.103	5.642	0.631	8.981	0.005	0.005	100.296
JR-MA-018-037	41.015	0.012	21.937	2.796	19.094	5.657	0.645	8.632	0.000	0.000	99.788
JR-MA-006-002	41.390	0.172	21.748	2.783	20.408	4.719	0.433	8.374	0.023	0.000	100.050

Appendix E. Garnets

Sample	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	MnO	FeO	Na_2O	K_2O	Total
JR-MA-025-002	41.322	0.177	21.655	2.770	20.637	4.462	0.412	8.324	0.047	0.001	99.807
JR-MA-073-001	41.514	0.115	22.012	2.705	20.688	4.863	0.397	7.443	0.030	0.000	99.767
JR-MA-018-020	41.821	0.351	21.135	2.667	21.230	4.737	0.277	7.849	0.026	0.000	100.093
JR-MA-018-016	41.432	0.376	20.980	2.664	21.077	4.680	0.271	7.677	0.048	0.001	99.206
JR-MA-018-017	41.729	0.131	22.174	2.557	20.610	4.761	0.394	7.877	0.017	0.002	100.252
JR-MA-037-003	41.168	0.211	21.783	2.443	20.789	4.630	0.404	8.381	0.045	0.000	99.854
JR-MA-018-013	41.896	0.335	21.410	2.310	21.212	4.502	0.284	7.808	0.029	0.004	99.790
JR-MA-094-001	41.135	0.016	19.623	5.021	17.515	6.094	0.560	10.150	0.029	0.000	100.143
JR-MA-094-003	41.862	0.002	20.068	4.728	19.831	5.377	0.475	7.714	0.003	0.003	100.063
JR-MA-095-001	40.387	0.050	20.168	3.279	15.211	6.183	0.727	13.698	0.015	0.000	99.718
JR-MA-098-001	41.636	0.000	20.323	4.541	20.336	4.816	0.466	7.569	0.006	0.002	99.695
JR-MA-098-002	41.645	0.000	20.741	3.944	20.764	4.674	0.509	7.310	0.014	0.002	99.603
JR-MA-101-001	41.389	0.102	19.995	4.709	19.545	5.246	0.479	7.840	0.020	0.000	99.325
JR-MA-123-001	41.227	0.449	18.204	6.690	20.669	5.624	0.330	6.424	0.034	0.005	99.656
JR-MA-130-001	41.502	0.164	20.011	4.644	19.787	5.476	0.435	7.827	0.029	0.000	99.875
JR-MA-139-001	41.044	0.003	20.334	4.169	19.093	6.168	0.535	8.121	0.009	0.000	99.476
JR-MA-141-005	41.204	0.086	21.064	3.121	19.372	5.449	0.488	8.559	0.018	0.001	99.362
JR-MA-152-001	42.084	0.141	20.187	4.634	19.990	5.210	0.440	7.393	0.035	0.000	100.114
JR-MA-152-002	41.939	0.000	21.222	3.558	20.730	4.433	0.524	7.500	0.007	0.005	99.918
JR-MA-152-003	42.079	0.031	21.013	3.528	19.956	4.981	0.495	7.901	0.023	0.010	100.017
JR-MA-152-004	42.172	0.070	21.223	3.315	20.675	4.862	0.405	7.817	0.008	0.000	100.547
JR-MA-157-001	41.847	0.000	20.255	4.780	19.933	5.085	0.498	7.390	0.007	0.000	99.795
JR-MA-157-009	41.405	0.102	18.024	6.944	18.660	6.258	0.474	7.979	0.025	0.000	99.871
JR-MA-160-001	41.790	0.216	18.896	5.929	20.521	5.433	0.383	7.032	0.040	0.005	100.245
JR-MA-160-002	41.603	0.122	19.833	5.205	19.502	5.430	0.493	7.820	0.037	0.000	100.045
JR-SG-001-001	42.006	0.004	21.266	3.100	19.133	5.484	0.636	8.547	0.020	0.004	100.200
JR-SG-001-010	41.893	0.000	21.604	2.806	19.250	5.561	0.653	8.641	0.007	0.000	100.415
JR-SG-001-011	41.599	0.294	18.020	7.161	19.843	5.931	0.377	6.979	0.041	0.000	100.245
JR-SG-001-012	41.511	0.429	18.733	5.734	20.928	5.359	0.316	6.507	0.048	0.000	99.565
JR-SG-001-013	41.557	0.083	20.202	4.727	19.234	5.441	0.541	8.355	0.018	0.000	100.158
JR-SG-001-014	41.439	0.964	20.402	2.241	20.271	5.145	0.292	8.777	0.071	0.002	99.604

Appendix E. Garnets

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
GROUP II ECLOGITIC GARNETS											
JR-MA-006-010	37.339	0.060	16.416	0.012	0.000	33.857	0.459	10.173	0.000	0.000	98.316
JR-MA-007-005	35.628	0.139	19.908	0.000	1.113	1.129	26.515	14.916	0.034	0.000	99.382
JR-MA-017-009	37.198	0.026	13.551	0.008	0.017	33.375	0.421	13.669	0.000	0.000	98.265
JR-MA-018-001	40.696	0.050	22.313	1.711	18.066	4.761	0.414	11.638	0.010	0.000	99.659
JR-MA-018-005	41.251	0.185	22.596	1.494	20.090	4.586	0.441	9.268	0.006	0.000	99.917
JR-MA-018-006	42.002	0.351	21.563	1.837	20.976	4.663	0.291	8.294	0.048	0.000	100.025
JR-MA-018-030	41.663	0.374	21.580	1.933	21.363	4.746	0.280	7.802	0.031	0.000	99.772
JR-MA-018-034	37.957	0.126	16.790	0.015	0.078	34.281	0.341	9.193	0.000	0.002	98.783
JR-MA-020-005	35.761	0.000	20.538	0.004	0.916	1.911	22.972	17.547	0.004	0.000	99.653
JR-MA-025-010	40.401	0.075	22.713	0.177	15.037	4.995	0.490	16.175	0.022	0.000	100.085
JR-MA-025-014	37.429	0.299	15.872	0.018	0.107	34.513	0.425	9.838	0.000	0.000	98.501
JR-MA-049-002	37.353	0.251	20.948	0.000	0.446	18.877	7.036	14.590	0.000	0.000	99.501
JR-MA-076-001	35.942	0.000	20.425	0.026	2.069	0.985	18.156	21.822	0.000	0.000	99.425
JR-MA-101-002	37.492	0.197	20.528	0.008	1.097	12.388	10.300	17.908	0.000	0.000	99.918
JR-MA-130-002	39.085	0.087	18.032	0.000	0.089	34.700	0.187	7.675	0.000	0.001	99.856
JR-MA-130-003	38.352	0.138	20.156	0.000	0.089	27.171	5.625	7.945	0.005	0.000	99.481
JR-MA-141-006	39.445	0.189	19.981	0.000	0.106	32.556	0.961	6.792	0.002	0.004	100.036
JR-MA-157-004	36.903	0.056	19.879	0.000	0.831	1.201	23.738	17.923	0.010	0.000	100.541
JR-MA-157-007	40.660	0.001	22.352	0.180	14.679	4.331	0.584	17.092	0.003	0.000	99.882
JR-SG-002-007	38.974	0.269	18.097	0.009	0.081	32.074	1.294	8.576	0.003	0.000	99.377
CR-POOR MEGACRYSTS											
JR-MA-003-005	40.839	0.435	22.275	0.559	19.630	4.545	0.378	10.422	0.052	0.003	99.138
JR-MA-003-006	41.357	0.506	22.275	0.173	18.742	4.694	0.419	11.835	0.069	0.001	100.071
JR-MA-004-002	41.240	0.734	21.183	1.884	20.991	4.628	0.287	8.593	0.061	0.000	99.601
JR-MA-007-002	40.940	1.184	20.794	1.505	20.005	4.961	0.330	9.481	0.078	0.000	99.278
JR-MA-007-004	40.841	0.942	21.422	1.023	19.295	4.751	0.365	11.061	0.090	0.003	99.793
JR-MA-015-001	40.543	0.577	22.156	0.159	17.902	4.707	0.470	13.128	0.061	0.003	99.706
JR-MA-017-006	40.594	0.982	21.760	0.192	18.572	5.154	0.418	11.759	0.099	0.002	99.532
JR-MA-018-010	41.644	0.475	21.580	1.899	20.757	4.488	0.336	8.855	0.045	0.004	100.083
JR-MA-018-025	41.337	0.456	22.017	1.063	20.370	4.671	0.363	9.586	0.055	0.000	99.918
JR-MA-018-026	40.929	0.458	22.533	0.173	18.157	4.381	0.470	12.777	0.058	0.000	99.936
JR-MA-018-027	41.167	0.469	21.931	1.545	20.096	4.504	0.363	9.856	0.054	0.000	99.985
JR-MA-018-028	40.910	0.744	21.686	1.025	19.793	4.487	0.343	9.988	0.072	0.002	99.050

Appendix E. Garnets

Sample	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	MnO	FeO	Na_2O	K_2O	Total
JR-MA-018-029	40.848	0.595	21.918	0.396	18.400	4.792	0.442	12.302	0.054	0.003	99.750
JR-MA-018-039	41.435	0.486	22.498	0.573	19.754	4.441	0.412	10.601	0.047	0.005	100.252
JR-MA-020-002	40.851	0.757	21.782	0.393	18.051	4.949	0.437	12.639	0.075	0.003	99.937
JR-MA-020-003	40.747	0.562	22.151	0.542	18.963	4.670	0.416	11.299	0.054	0.000	99.404
JR-MA-023-003	41.581	0.497	22.790	0.324	20.113	4.011	0.379	10.554	0.060	0.003	100.312
JR-MA-023-004	41.074	0.530	22.480	0.503	19.948	4.108	0.373	10.470	0.077	0.001	99.564
JR-MA-025-006	41.394	1.031	20.381	2.735	20.927	5.158	0.256	7.941	0.059	0.006	99.888
JR-MA-025-007	40.952	0.738	21.861	0.821	19.270	4.553	0.384	10.899	0.071	0.000	99.549
JR-MA-025-008	41.119	0.838	20.713	2.581	21.245	4.580	0.302	8.170	0.044	0.000	99.592
JR-MA-025-009	41.437	0.668	21.767	0.857	19.706	4.445	0.341	10.284	0.075	0.001	99.581
JR-MA-025-011	41.674	0.911	20.386	2.883	20.826	5.157	0.259	7.913	0.057	0.000	100.066
JR-MA-025-012	41.653	0.668	22.292	0.913	19.470	4.325	0.395	10.803	0.073	0.000	100.592
JR-MA-039-003	40.893	0.871	21.948	0.316	19.008	4.702	0.403	11.721	0.112	0.000	99.974
JR-MA-039-004	41.391	1.076	21.262	1.586	20.368	5.085	0.312	9.132	0.059	0.001	100.272
JR-MA-042-001	41.532	0.818	21.470	1.047	19.554	4.871	0.351	10.085	0.105	0.000	99.833
JR-MA-053-003	40.998	0.773	21.594	0.813	19.313	4.571	0.297	10.997	0.042	0.000	99.398
JR-MA-053-004	40.743	0.595	22.377	0.028	18.306	4.311	0.454	13.334	0.074	0.000	100.222
JR-MA-137-001	42.295	0.556	22.047	1.265	21.457	3.901	0.316	7.842	0.072	0.002	99.753
JR-MA-157-006	41.941	0.717	21.105	1.680	20.018	4.736	0.345	9.420	0.057	0.001	100.020
JR-MA-157-010	41.688	0.692	21.707	0.665	19.320	4.536	0.397	11.059	0.082	0.000	100.146
JR-MA-160-003	41.656	0.883	21.328	1.300	19.847	4.746	0.325	9.456	0.081	0.004	99.626
JR-MA-160-004	41.953	0.701	21.575	1.238	19.805	4.463	0.360	10.030	0.075	0.000	100.200
JR-MA-160-005	42.349	0.482	21.591	1.068	19.896	4.511	0.347	9.667	0.069	0.000	99.980
CRUSTAL GARNETS											
JR-MA-006-008	37.982	0.102	21.505	0.099	7.625	6.007	0.820	25.893	0.000	0.000	100.033
JR-MA-006-009	36.854	0.033	20.725	0.000	0.734	9.176	3.701	28.799	0.000	0.000	100.022
JR-MA-007-003	37.751	0.094	21.223	0.037	5.838	7.153	0.932	26.727	0.000	0.000	99.755
JR-MA-015-002	36.271	0.024	21.068	0.000	3.110	1.589	4.147	33.594	0.000	0.000	99.803
JR-MA-017-007	38.252	0.052	21.506	0.060	8.231	5.913	0.798	24.891	0.000	0.000	99.703
JR-MA-017-008	37.881	0.115	21.239	0.004	7.173	6.505	0.881	25.839	0.000	0.001	99.638
JR-MA-018-009	36.431	0.000	21.083	0.044	3.046	1.750	0.718	37.005	0.000	0.000	100.077
JR-MA-018-011	36.927	0.004	20.992	0.006	3.454	2.037	0.680	35.811	0.000	0.000	99.911
JR-MA-018-019	35.988	0.019	20.762	0.000	1.866	1.168	1.095	38.723	0.000	0.000	99.621
JR-MA-018-023	36.819	0.000	21.211	0.007	4.672	1.260	1.296	34.340	0.000	0.000	99.605

Appendix E. Garnets

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	Total
JR-MA-018-031	38.370	0.115	21.677	0.121	7.347	9.246	0.810	22.264	0.000	0.000	99.950
JR-MA-018-032	38.729	0.116	22.034	0.196	10.493	5.708	0.811	22.072	0.000	0.000	100.159
JR-MA-018-033	38.004	0.088	21.453	0.010	5.376	6.908	1.418	27.035	0.000	0.000	100.292
JR-MA-018-035	36.710	0.030	21.176	0.018	1.458	8.458	10.933	21.189	0.000	0.000	99.972
JR-MA-020-004	37.434	0.125	21.015	0.010	6.047	6.838	0.669	27.244	0.000	0.002	99.384
JR-MA-023-005	37.472	0.063	21.643	0.011	3.362	10.763	0.785	25.906	0.000	0.000	100.005
JR-MA-025-013	39.109	0.037	22.078	0.128	10.979	3.176	0.428	24.266	0.006	0.000	100.207
JR-MA-028-002	38.019	0.085	21.696	0.047	8.836	5.829	0.681	23.933	0.000	0.000	99.126
JR-MA-030-001	39.323	0.035	22.381	0.096	11.807	3.561	0.484	22.901	0.006	0.000	100.594
JR-MA-037-006	39.837	0.024	22.602	0.000	13.239	4.105	0.364	20.090	0.000	0.002	100.263
JR-MA-037-007	38.850	0.131	22.015	0.009	9.015	9.156	0.462	20.208	0.004	0.000	99.850
JR-MA-049-001	36.209	0.100	20.672	0.002	1.014	0.268	15.682	26.439	0.000	0.000	100.386
JR-MA-053-005	38.553	0.062	21.474	0.086	8.031	6.033	0.881	25.344	0.000	0.000	100.464
JR-MA-061-001	35.748	0.088	20.322	0.008	0.486	0.750	21.555	20.830	0.003	0.000	99.790
JR-MA-063-001	36.378	0.030	20.906	0.000	2.914	5.339	3.262	30.556	0.000	0.000	99.385
JR-MA-076-002	35.761	0.000	20.615	0.000	1.194	1.267	18.130	22.665	0.000	0.000	99.632
JR-MA-080-001	38.732	0.050	21.480	0.036	8.014	6.737	0.530	24.480	0.000	0.000	100.059
JR-MA-082-001	37.887	0.082	21.334	0.006	7.309	6.064	0.843	26.008	0.000	0.003	99.536
JR-MA-082-002	38.071	0.123	21.799	0.126	7.550	4.982	0.790	27.035	0.000	0.000	100.476
JR-MA-157-002	36.142	0.005	20.331	0.000	2.165	2.465	1.479	36.871	0.000	0.000	99.458
JR-MA-157-005	36.097	0.025	20.363	0.021	1.314	0.984	14.310	26.739	0.000	0.000	99.853
JR-MA-157-008	37.195	0.097	20.601	0.007	0.670	6.238	6.500	29.270	0.000	0.000	100.578
JR-MA-157-011	37.686	0.047	21.104	0.000	2.260	12.076	1.321	25.554	0.000	0.002	100.050
JR-SG-005-001	38.403	0.036	21.492	0.165	8.471	4.193	0.731	26.074	0.000	0.000	99.565
JR-SG-005-002	38.555	0.063	21.155	0.080	6.857	7.175	0.897	25.192	0.000	0.000	99.974
JR-SG-005-003	38.176	0.025	20.540	0.005	3.259	4.622	0.335	34.033	0.000	0.000	100.995
JR-MA-006-011	36.611	1.356	13.324	0.012	0.191	34.584	0.211	11.654	0.005	0.001	97.949
STAUROLITE											
JR-MA-006-007	26.314	0.487	54.193	0.010	1.715	0.003	0.141	14.015	0.000	0.002	96.880
JR-MA-018-040	27.126	0.497	54.669	0.047	2.013	0.000	0.291	13.454	0.000	0.000	98.097
JR-MA-020-006	26.423	0.577	54.240	0.087	1.971	0.002	0.371	13.235	0.000	0.000	96.906
JR-MA-029-024	27.310	0.572	53.699	0.013	2.032	0.000	0.035	13.503	0.013	0.000	97.177
JR-MA-053-006	26.444	0.552	54.498	0.044	2.005	0.003	0.285	13.279	0.000	0.000	97.110

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
CHROMITES															
DIAMOND INCLUSION AND INTERGROWTH FIELD															
JR-MA-088-005	0.095	1.786	0.000	5.257	63.299	0.146	12.881	0.309	15.372	0.115	0.052	99.312	0.985	14.486	99.411
FIELD UNIQUE TO KIMBERLITE AND LAMPROITE															
JR-MA-017-026	0.057	2.217	0.000	10.703	48.001	0.450	8.459	0.405	28.951	0.124	0.136	99.503	6.724	22.900	100.177
JR-MA-025-033	0.101	1.949	0.009	3.647	58.399	0.257	9.804	0.352	24.925	0.119	0.070	99.632	6.136	19.404	100.247
JR-MA-030-009	0.076	2.726	0.044	0.558	52.411	0.548	6.812	0.507	34.701	0.193	0.149	98.725	11.723	24.152	99.900
JR-MA-030-011	0.084	2.453	0.020	1.092	51.161	0.422	6.825	0.475	35.920	0.187	0.106	98.745	13.387	23.874	100.086
JR-MA-037-038	0.025	3.303	0.016	10.329	42.599	0.438	3.388	0.647	37.575	0.090	0.388	98.798	7.440	30.881	99.543
JR-MA-037-073	0.069	4.893	0.009	9.783	40.474	0.643	8.900	0.425	33.375	0.218	0.070	98.859	9.744	24.607	99.835
JR-MA-050-008	0.071	3.086	0.016	12.950	43.735	0.250	12.056	0.308	25.554	0.176	0.098	98.300	8.421	17.977	99.144
JR-MA-065-002	0.054	2.546	0.000	12.654	44.805	0.433	8.919	0.357	28.447	0.175	0.167	98.557	6.681	22.435	99.226
JR-MA-065-019	0.085	3.184	0.016	11.396	45.716	0.486	10.466	0.336	26.733	0.145	0.100	98.663	6.674	20.727	99.332
JR-MA-078-009	0.058	2.671	0.000	11.245	45.055	0.403	8.160	0.368	30.993	0.149	0.128	99.230	8.065	23.736	100.038
JR-MA-080-004	0.054	3.222	0.000	10.763	45.936	0.459	8.738	0.353	29.404	0.200	0.090	99.219	6.753	23.328	99.896
JR-MA-081-004	0.051	2.158	0.000	10.936	50.206	0.407	10.495	0.326	24.358	0.157	0.092	99.186	5.228	19.653	99.710
JR-MA-081-007	0.038	2.404	0.000	11.341	45.425	0.480	8.141	0.337	31.054	0.119	0.136	99.475	8.100	23.766	100.287
JR-MA-084-007	0.046	2.591	0.000	12.081	46.438	0.442	9.371	0.348	27.659	0.217	0.175	99.368	6.385	21.913	100.008
JR-MA-094-024	0.084	2.641	0.121	8.174	49.189	0.470	7.949	0.335	29.472	0.134	0.134	98.703	6.471	23.649	99.351
JR-MA-128-002	0.056	2.426	0.016	13.028	43.629	0.252	4.645	0.515	34.226	0.163	0.246	99.202	6.203	28.645	99.823
JR-MA-140-011	0.041	8.279	0.011	9.656	41.689	0.243	5.852	0.514	31.830	0.104	0.232	98.451	0.662	31.234	98.517
JR-MA-140-016	0.088	3.392	0.016	11.069	43.245	0.419	9.109	0.330	31.288	0.186	0.113	99.255	9.182	23.026	100.175
JR-MA-144-001	0.055	3.774	0.018	11.966	43.146	0.372	4.496	0.616	34.587	0.129	0.229	99.388	4.994	30.093	99.888
JR-MA-144-005	0.028	1.976	0.004	8.967	51.301	0.382	8.879	0.340	26.998	0.144	0.100	99.119	6.031	21.571	99.723
JR-MA-144-006	0.058	2.848	0.000	11.457	42.069	0.444	8.661	0.344	32.668	0.144	0.108	98.801	10.548	23.177	99.858
JR-MA-144-013	0.039	2.718	0.050	12.883	42.478	0.466	9.586	0.281	30.662	0.146	0.099	99.408	9.435	22.172	100.353
JR-MA-144-014	0.063	2.731	0.000	11.741	45.428	0.460	10.012	0.298	27.962	0.176	0.084	98.955	7.608	21.117	99.717
JR-MA-153-005	0.050	2.783	0.000	13.473	45.237	0.288	5.701	0.478	30.653	0.116	0.375	99.154	3.661	27.359	99.521
JR-MA-160-016	0.083	2.478	0.036	12.937	43.884	0.326	7.978	0.377	30.287	0.197	0.145	98.728	7.201	23.808	99.449
JR-MA-173-009	0.056	3.632	0.000	9.901	44.735	0.665	9.453	0.385	29.526	0.190	0.113	98.656	7.718	22.581	99.429
JR-SG-002-024	0.038	2.651	0.000	11.265	44.337	0.449	4.276	0.517	35.281	0.091	0.280	99.185	6.493	29.438	99.836
JR-SG-002-037	0.086	3.097	0.047	12.520	41.584	0.380	3.985	0.569	36.659	0.089	0.230	99.246	6.840	30.505	99.931
JR-SG-002-038	0.091	3.118	0.000	9.972	43.379	0.469	8.401	0.318	32.861	0.142	0.103	98.854	10.171	23.709	99.873
NON KIMBERLITIC/LAMPROITIC FIELD															
JR-MA-018-071	0.058	5.447	0.000	10.266	35.756	0.428	7.163	0.436	39.492	0.226	0.156	99.428	13.187	27.626	100.749
JR-MA-073-003	0.091	6.813	0.000	8.540	34.411	0.456	6.320	0.475	41.407	0.283	0.134	98.930	12.985	29.723	100.231
JR-MA-073-005	0.214	0.839	0.000	33.382	30.166	0.149	16.552	0.172	17.588	0.281	0.059	99.402	5.454	12.680	99.948

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NIO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-073-007	0.104	1.835	0.000	27.575	32.208	0.173	14.877	0.199	21.695	0.226	0.068	98.960	7.408	15.029	99.702
JR-MA-073-017	0.116	1.557	0.017	33.023	26.202	0.134	14.948	0.203	22.613	0.188	0.088	99.089	7.835	15.563	99.874
JR-MA-073-022	0.099	2.555	0.000	22.559	34.147	0.197	13.523	0.210	24.008	0.233	0.076	97.607	8.294	16.545	98.438
JR-MA-073-024	0.062	6.098	0.000	7.795	37.297	0.454	6.504	0.451	38.976	0.286	0.150	98.073	11.808	28.351	99.256
JR-MA-073-026	0.121	2.262	0.000	24.188	33.766	0.179	13.631	0.227	24.072	0.168	0.073	98.687	8.119	16.766	99.500
JR-MA-076-012	0.187	0.838	0.000	34.881	28.424	0.157	17.193	0.163	16.554	0.276	0.060	98.733	5.385	11.709	99.272
JR-MA-076-017	0.158	0.852	0.000	34.202	29.312	0.211	16.970	0.160	17.037	0.243	0.042	99.187	5.376	12.199	99.726
JR-MA-077-015	0.119	3.415	0.000	23.643	31.648	0.241	13.606	0.235	25.781	0.270	0.103	99.061	8.817	17.847	99.944
JR-MA-077-017	0.217	0.808	0.000	35.036	28.812	0.150	17.263	0.152	16.536	0.255	0.060	99.289	5.225	11.835	99.812
JR-MA-077-023	0.083	2.350	0.019	26.572	31.925	0.177	13.897	0.239	23.223	0.198	0.108	98.791	7.222	16.725	99.515
JR-MA-109-013	0.188	0.901	0.017	35.591	29.553	0.143	17.502	0.182	14.645	0.250	0.056	99.028	3.524	11.474	99.381
JR-MA-109-019	0.194	0.870	0.000	39.097	24.661	0.158	17.228	0.185	16.919	0.277	0.072	99.661	4.785	12.613	100.140
JR-MA-112-005	0.090	1.622	0.002	31.862	29.660	0.159	15.856	0.183	19.808	0.217	0.066	99.525	6.271	14.165	100.153
JR-MA-112-007	0.214	0.778	0.000	35.544	29.444	0.170	17.507	0.164	15.193	0.274	0.058	99.346	4.091	11.512	99.756
JR-MA-128-010	0.119	1.366	0.000	33.687	30.228	0.153	17.139	0.165	16.283	0.229	0.075	99.444	4.507	12.227	99.896
JR-MA-152-054	0.150	0.973	0.000	32.904	30.564	0.110	16.619	0.177	16.882	0.202	0.050	98.631	5.086	12.306	99.141
JR-SG-001-034	0.115	1.736	0.000	30.325	29.635	0.166	15.325	0.211	21.719	0.200	0.079	99.511	7.607	14.874	100.273
JR-SG-003-025	0.198	0.761	0.000	35.064	29.630	0.160	17.611	0.196	16.137	0.249	0.049	100.055	5.185	11.472	100.574
JR-SG-003-005	0.093	3.750	0.023	17.912	33.498	0.263	11.564	0.342	31.381	0.185	0.124	99.135	12.171	20.430	100.354
JR-TM-001-006	0.143	0.944	0.019	35.801	28.369	0.153	17.320	0.161	17.542	0.256	0.052	100.760	5.720	12.395	101.333
JR-TM-002-008	0.081	6.899	0.057	17.372	35.601	0.354	3.238	0.451	34.290	0.113	0.140	98.596	0.000	34.290	98.596
JR-MA-076-024	0.168	0.861	0.043	33.861	29.881	0.111	16.965	0.198	16.405	0.242	0.053	98.788	5.030	11.879	99.292
OVERLAP FIELD POSSIBLE KIMBERLITIC															
JR-MA-003-013	0.085	0.323	0.000	15.751	52.353	0.182	11.552	0.338	19.961	0.122	0.090	100.757	2.929	17.326	101.050
JR-MA-003-014	0.122	0.300	0.016	12.589	53.775	0.168	10.595	0.323	22.385	0.111	0.088	100.472	4.565	18.277	100.929
JR-MA-004-003	0.137	0.300	0.009	13.751	54.297	0.193	12.448	0.292	18.471	0.139	0.067	100.104	3.237	15.558	100.428
JR-MA-006-021	0.135	0.301	0.064	13.931	54.513	0.170	13.716	0.234	16.792	0.165	0.042	100.063	3.429	13.707	100.407
JR-MA-006-022	0.069	0.557	0.025	12.667	54.896	0.182	12.072	0.275	19.529	0.120	0.071	100.463	3.635	16.258	100.827
JR-MA-006-023	0.058	0.709	0.014	14.794	46.837	0.311	5.986	0.407	30.975	0.065	0.169	100.325	5.484	26.041	100.874
JR-MA-006-024	0.113	0.332	0.000	12.562	53.663	0.187	9.054	0.331	23.856	0.109	0.119	100.326	3.656	20.567	100.692
JR-MA-006-025	0.062	0.550	0.000	14.115	50.407	0.208	7.165	0.392	27.091	0.109	0.125	100.224	3.694	23.767	100.594
JR-MA-006-026	0.594	0.123	0.023	20.017	36.909	0.312	2.281	0.478	38.786	0.076	0.225	99.824	7.043	32.449	100.530
JR-MA-006-027	0.082	0.890	0.000	12.175	48.542	0.300	5.568	0.468	31.360	0.107	0.143	99.635	5.805	26.137	100.217
JR-MA-006-028	0.076	1.013	0.045	13.539	49.651	0.202	6.715	0.470	28.268	0.085	0.254	100.318	3.971	24.695	100.716
JR-MA-006-029	0.053	1.004	0.032	14.890	50.096	0.232	11.589	0.332	21.712	0.146	0.104	100.190	4.538	17.628	100.645
JR-MA-006-030	0.058	1.059	0.000	13.696	50.684	0.207	7.219	0.408	26.651	0.067	0.227	100.276	2.941	24.005	100.571
JR-MA-006-031	0.088	0.520	0.000	9.772	52.477	0.283	8.429	0.323	27.638	0.062	0.116	99.708	7.060	21.285	100.415
JR-MA-006-032	0.031	0.370	0.027	13.787	52.640	0.190	11.293	0.301	21.246	0.132	0.101	100.118	4.429	17.261	100.562

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-006-033	0.101	1.357	0.022	7.293	51.129	0.222	7.258	0.327	31.722	0.170	0.082	99.683	9.320	23.336	100.617
JR-MA-006-034	0.064	0.562	0.041	12.889	52.379	0.218	10.947	0.295	22.482	0.095	0.109	100.081	5.031	17.955	100.585
JR-MA-006-035	0.169	0.290	0.000	13.860	55.060	0.136	13.067	0.233	17.081	0.162	0.062	100.120	2.755	14.602	100.396
JR-MA-006-036	0.048	1.038	0.000	12.626	49.693	0.277	10.227	0.322	25.487	0.116	0.091	99.925	6.739	19.423	100.600
JR-MA-006-037	0.129	0.254	0.000	11.277	53.043	0.124	6.604	0.685	26.970	0.049	0.313	99.448	4.171	23.217	99.866
JR-MA-006-038	0.069	0.813	0.030	14.142	50.478	0.331	11.273	0.296	22.770	0.120	0.094	100.416	5.136	18.149	100.931
JR-MA-006-039	0.159	0.360	0.009	12.580	53.496	0.117	9.573	0.331	23.604	0.118	0.071	100.418	4.190	19.834	100.838
JR-MA-007-027	0.105	0.671	0.076	9.649	51.373	0.204	6.786	1.633	29.172	0.118	0.244	100.031	7.409	22.505	100.773
JR-MA-007-027d	0.099	0.653	0.002	9.722	51.456	0.151	6.852	1.604	29.055	0.123	0.230	99.947	7.562	22.251	100.705
JR-MA-007-030	0.127	0.374	0.000	12.541	53.585	0.131	9.787	0.307	23.260	0.116	0.079	100.307	4.215	19.468	100.729
JR-MA-007-031	0.163	0.344	0.029	10.879	53.755	0.193	7.837	0.489	25.904	0.102	0.200	99.895	4.422	21.925	100.338
JR-MA-007-045	0.085	0.412	0.009	12.247	53.483	0.185	10.154	0.334	23.292	0.079	0.112	100.392	4.828	18.947	100.876
JR-MA-007-061	0.059	0.330	0.000	12.232	54.399	0.219	11.355	0.288	20.957	0.110	0.075	100.024	4.433	16.968	100.468
JR-MA-007-062	0.110	0.394	0.000	15.001	49.898	0.246	10.440	0.285	23.317	0.119	0.069	99.879	4.873	18.933	100.367
JR-MA-007-063	0.101	0.376	0.030	14.078	51.195	0.192	10.387	0.305	23.371	0.065	0.106	100.206	4.980	18.890	100.705
JR-MA-007-064	0.173	0.283	0.000	14.086	54.937	0.147	14.589	0.215	15.295	0.207	0.035	99.967	3.347	12.283	100.302
JR-MA-007-065	0.127	0.053	0.000	13.238	58.821	0.203	14.149	0.265	13.828	0.088	0.072	100.844	1.012	12.917	100.945
JR-MA-007-066	0.077	0.416	0.013	10.872	49.717	0.203	0.811	0.992	35.120	0.010	1.598	99.829	4.676	30.912	100.298
JR-MA-007-067	0.050	0.251	0.000	17.445	36.338	0.411	0.919	0.757	43.004	0.067	0.268	99.510	10.767	33.316	100.589
JR-MA-007-068	0.147	0.282	0.055	14.579	54.529	0.137	14.257	0.195	16.118	0.189	0.048	100.536	3.376	13.081	100.874
JR-MA-007-069	0.188	0.306	0.000	14.158	55.884	0.171	15.721	0.192	13.577	0.213	0.018	100.428	3.069	10.815	100.736
JR-MA-007-070	0.157	0.275	0.000	14.590	54.999	0.166	14.273	0.299	15.251	0.223	0.043	100.276	2.692	12.828	100.546
JR-MA-007-071	0.085	0.584	0.011	13.520	49.592	0.196	5.609	0.498	29.650	0.115	0.244	100.104	4.217	25.856	100.526
JR-MA-007-072	0.066	0.642	0.029	11.024	48.344	0.272	1.329	0.379	37.466	0.062	0.340	99.953	5.808	32.240	100.535
JR-MA-007-073	0.172	0.221	0.000	12.275	56.441	0.109	11.312	0.323	19.201	0.148	0.036	100.238	2.536	16.919	100.492
JR-MA-007-074	0.117	0.387	0.000	12.304	54.119	0.231	10.036	0.331	22.727	0.108	0.107	100.467	3.912	19.207	100.859
JR-MA-007-075	0.095	0.352	0.016	14.107	50.967	0.252	9.950	0.314	23.767	0.083	0.093	99.996	4.711	19.528	100.468
JR-MA-007-076	0.054	1.187	0.000	11.329	50.224	0.335	9.528	0.322	26.564	0.107	0.101	99.751	6.778	20.465	100.430
JR-MA-007-077	0.086	0.549	0.002	14.143	53.423	0.169	12.135	0.286	19.140	0.082	0.152	100.167	3.249	16.217	100.493
JR-MA-007-078	0.123	0.417	0.018	14.004	51.668	0.187	10.110	0.281	23.344	0.068	0.102	100.322	4.382	19.401	100.761
JR-MA-007-079	0.201	0.298	0.000	12.637	52.647	0.115	9.193	0.345	24.756	0.113	0.084	100.389	4.850	20.392	100.875
JR-MA-007-080	0.053	0.561	0.005	14.601	47.184	0.262	6.135	0.499	30.808	0.109	0.126	100.343	5.928	25.474	100.937
JR-MA-007-081	0.107	0.311	0.105	13.529	53.736	0.189	11.615	0.300	20.286	0.141	0.096	100.415	3.733	16.927	100.789
JR-MA-014-001	0.071	0.479	0.014	12.001	51.282	0.207	6.436	0.498	28.973	0.099	0.190	100.250	5.099	24.384	100.761
JR-MA-015-016	0.056	0.860	0.009	12.526	50.153	0.315	6.440	0.480	28.902	0.061	0.388	100.190	4.567	24.793	100.648
JR-MA-015-018	0.046	0.101	0.000	15.601	50.547	0.223	9.723	0.372	23.564	0.093	0.197	100.467	4.250	19.740	100.893
JR-MA-015-019	0.063	1.537	0.000	12.236	48.768	0.405	8.823	0.322	27.541	0.162	0.135	99.992	6.043	22.104	100.597
JR-MA-015-020	0.041	1.163	0.000	13.659	49.675	0.272	6.926	0.444	27.900	0.108	0.238	100.426	3.674	24.594	100.794
JR-MA-015-021	0.074	1.685	0.000	11.175	50.564	0.343	9.627	0.422	26.017	0.094	0.095	100.096	5.811	20.788	100.678

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-015-022	0.037	0.842	0.054	12.089	50.458	0.265	5.749	0.482	30.393	0.136	0.173	100.678	4.892	25.991	101.168
JR-MA-017-016	0.138	0.314	0.000	13.618	55.413	0.121	11.374	0.290	18.854	0.123	0.061	100.306	1.904	17.140	100.497
JR-MA-017-017	0.030	0.009	0.000	13.508	55.615	0.206	12.416	0.350	18.297	0.064	0.147	100.642	3.337	15.294	100.976
JR-MA-017-018	0.114	0.368	0.000	13.014	55.139	0.207	11.700	0.316	19.180	0.065	0.082	100.185	2.774	16.684	100.463
JR-MA-017-019	0.158	0.312	0.032	13.439	56.270	0.133	14.227	0.262	15.543	0.174	0.043	100.593	2.913	12.922	100.885
JR-MA-017-020	0.154	0.350	0.000	12.155	55.722	0.126	11.872	0.258	19.650	0.141	0.068	100.496	3.714	16.308	100.868
JR-MA-017-021	0.150	0.267	0.000	11.418	53.803	0.122	9.379	0.336	24.591	0.115	0.107	100.288	5.332	19.793	100.822
JR-MA-017-022	0.113	1.772	0.000	24.334	37.197	0.205	14.140	0.229	21.519	0.180	0.069	99.758	6.243	15.901	100.384
JR-MA-017-024	0.146	0.280	0.018	13.445	55.308	0.124	13.136	0.282	17.277	0.172	0.042	100.230	3.206	14.392	100.551
JR-MA-017-025	0.093	0.528	0.043	14.330	51.600	0.214	10.333	0.353	21.674	0.100	0.112	99.380	3.191	18.803	99.700
JR-MA-017-027	0.077	0.382	0.048	11.843	53.270	0.169	9.309	0.315	23.861	0.087	0.112	99.473	4.443	19.863	99.918
JR-MA-018-088	0.132	0.426	0.000	13.418	51.679	0.229	11.451	0.275	20.988	0.085	0.090	98.773	4.620	16.831	99.236
JR-MA-018-089	0.085	0.578	0.000	13.793	52.364	0.212	11.571	0.289	20.411	0.118	0.071	99.492	3.852	16.945	99.878
JR-MA-018-090	0.091	0.574	0.000	13.928	51.743	0.250	7.571	0.562	24.836	0.099	0.194	99.848	2.185	22.870	100.067
JR-MA-018-091	0.082	2.135	0.000	10.817	48.253	0.441	9.708	0.319	27.422	0.132	0.086	99.395	7.085	21.047	100.105
JR-MA-018-092	0.086	1.226	0.043	11.600	47.928	0.235	4.674	0.459	32.312	0.066	0.307	98.936	5.535	27.332	99.491
JR-MA-022-007	0.114	0.825	0.023	14.729	47.909	0.212	8.014	0.410	27.121	0.109	0.132	99.598	4.910	22.703	100.090
JR-MA-022-008	0.140	0.295	0.053	16.482	51.015	0.203	12.704	0.242	18.542	0.154	0.024	99.854	3.215	15.649	100.176
JR-MA-023-024	0.062	0.117	0.007	11.753	54.606	0.262	11.491	0.294	20.669	0.066	0.156	99.483	4.783	16.365	99.962
JR-MA-023-025	0.143	0.306	0.000	13.265	55.653	0.151	14.028	0.248	16.232	0.166	0.039	100.231	3.491	13.091	100.581
JR-MA-023-026	0.083	0.297	0.007	14.540	52.627	0.169	11.935	0.329	19.710	0.153	0.087	99.937	3.853	16.243	100.323
JR-MA-023-027	0.078	1.424	0.020	12.107	46.139	0.385	4.770	0.527	33.873	0.127	0.274	99.724	6.728	27.819	100.398
JR-MA-023-028	0.060	0.368	0.007	11.501	52.852	0.209	8.686	0.335	25.334	0.093	0.084	99.529	5.063	20.779	100.036
JR-MA-023-029	0.143	0.273	0.002	11.950	50.840	0.215	2.391	2.589	30.863	0.113	0.720	100.099	3.414	27.791	100.441
JR-MA-023-030	0.063	0.885	0.000	11.835	50.359	0.284	9.183	0.335	26.756	0.109	0.100	99.909	6.655	20.768	100.576
JR-MA-025-017	0.040	0.012	0.000	15.369	50.392	0.182	11.180	0.303	21.989	0.099	0.159	99.725	5.323	17.200	100.258
JR-MA-025-019	0.082	0.411	0.050	12.360	52.659	0.196	7.956	0.436	25.724	0.107	0.051	100.032	3.941	22.178	100.427
JR-MA-025-020	0.137	0.267	0.000	12.775	54.979	0.226	12.261	0.260	18.976	0.130	0.110	100.121	3.622	15.717	100.484
JR-MA-025-021	0.064	1.245	0.018	13.170	48.333	0.332	9.932	0.352	25.785	0.133	0.099	99.463	6.361	20.062	100.100
JR-MA-025-022	0.135	0.254	0.000	13.996	55.158	0.149	13.719	0.240	16.344	0.183	0.040	100.218	3.052	13.598	100.524
JR-MA-025-023	0.129	0.354	0.016	13.158	53.539	0.172	11.167	0.282	21.633	0.136	0.067	100.653	4.430	17.647	101.097
JR-MA-025-024	0.198	0.252	0.000	13.734	56.382	0.153	14.800	0.190	14.457	0.218	0.037	100.421	2.658	12.065	100.687
JR-MA-025-026	0.101	0.363	0.050	11.149	53.132	0.218	9.334	0.350	25.438	0.079	0.076	100.290	5.932	20.100	100.884
JR-MA-025-027	0.164	0.266	0.007	13.609	56.648	0.091	14.943	0.234	13.931	0.175	0.034	100.102	2.588	11.602	100.361
JR-MA-025-028	0.147	0.321	0.082	14.454	53.902	0.161	13.730	0.227	16.991	0.193	0.032	100.240	3.489	13.852	100.590
JR-MA-025-029	0.031	0.054	0.051	17.261	45.673	0.204	11.032	0.487	24.698	0.139	0.242	99.872	7.863	17.623	100.660
JR-MA-025-030	0.148	0.376	0.000	13.457	52.788	0.119	8.778	0.341	23.640	0.096	0.104	99.847	2.977	20.961	100.145
JR-MA-025-031	0.115	0.438	0.002	12.653	52.798	0.257	8.636	0.441	24.561	0.122	0.157	100.180	3.707	21.225	100.551
JR-MA-025-032	0.095	0.752	0.000	6.398	54.251	0.333	9.734	0.373	27.328	0.136	0.083	99.483	9.339	18.925	100.419

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-026-006	0.172	0.254	0.000	13.141	55.042	0.155	12.269	0.263	18.205	0.125	0.064	99.690	2.917	15.580	99.982
JR-MA-026-007	0.182	1.337	0.038	28.420	33.706	0.216	15.315	0.194	20.124	0.231	0.065	99.828	6.239	14.510	100.453
JR-MA-026-008	0.149	0.228	0.000	14.791	56.170	0.138	15.324	0.208	12.559	0.168	0.039	99.774	1.594	11.124	99.934
JR-MA-027-001	0.112	0.043	0.000	18.964	51.617	0.191	14.130	0.277	15.611	0.112	0.084	101.141	1.939	13.866	101.335
JR-MA-027-002	0.145	0.291	0.000	13.646	56.108	0.167	14.372	0.213	14.744	0.179	0.046	99.911	2.456	12.534	100.157
JR-MA-027-003	0.083	0.328	0.000	14.140	53.081	0.135	6.666	0.446	24.609	0.024	0.238	99.750	0.709	23.971	99.821
JR-MA-027-004	0.100	0.427	0.011	12.833	52.169	0.174	7.389	0.496	24.883	0.048	0.559	99.089	2.876	22.295	99.377
JR-MA-027-005	0.159	0.291	0.000	13.390	54.888	0.107	12.291	0.274	18.388	0.159	0.079	100.026	3.120	15.580	100.339
JR-MA-029-009	0.079	0.399	0.000	11.553	50.498	0.258	7.849	0.373	28.170	0.083	0.143	99.405	6.750	22.096	100.081
JR-MA-030-006	0.057	0.463	0.039	12.218	52.777	0.294	11.093	0.389	22.650	0.094	0.154	100.228	5.650	17.566	100.794
JR-MA-030-007	0.073	0.905	0.000	13.347	50.549	0.302	11.548	0.310	23.000	0.113	0.079	100.226	6.027	17.577	100.830
JR-MA-030-008	0.090	0.346	0.021	14.314	51.376	0.216	11.264	0.267	21.597	0.069	0.100	99.660	4.630	17.431	100.124
JR-MA-030-010	0.068	0.380	0.000	12.088	54.319	0.223	10.552	0.297	21.511	0.112	0.090	99.640	3.813	18.080	100.022
JR-MA-030-012	0.072	0.905	0.052	12.691	51.085	0.267	9.512	0.338	24.321	0.134	0.131	99.508	4.543	20.233	99.963
JR-MA-037-012	0.103	0.379	0.025	9.588	49.559	0.107	0.210	3.264	33.950	0.135	2.019	99.339	5.994	28.557	99.940
JR-MA-037-013	0.070	1.041	0.000	12.536	47.041	0.365	4.963	0.566	32.757	0.118	0.335	99.792	6.272	27.113	100.420
JR-MA-037-026	0.134	1.107	0.029	7.510	52.588	0.182	8.077	0.295	28.615	0.173	0.054	98.764	7.782	21.613	99.544
JR-MA-037-027	0.072	0.496	0.011	12.591	53.230	0.160	10.207	0.409	21.772	0.133	0.090	99.171	3.721	18.424	99.544
JR-MA-037-028	0.065	0.698	0.007	14.345	45.737	0.263	5.988	0.519	30.995	0.117	0.369	99.103	6.483	25.161	99.753
JR-MA-037-029	0.081	0.339	0.043	12.113	52.228	0.190	9.862	0.313	23.844	0.099	0.078	99.190	5.384	19.000	99.729
JR-MA-037-030	0.084	0.350	0.011	13.490	50.505	0.180	5.329	0.523	28.237	0.066	0.461	99.236	2.968	25.566	99.533
JR-MA-037-031	0.123	0.461	0.000	14.298	53.316	0.173	12.498	0.285	17.920	0.111	0.092	99.277	2.808	15.393	99.558
JR-MA-037-032	0.096	0.372	0.000	13.394	53.794	0.156	12.493	0.249	18.093	0.143	0.063	98.853	3.412	15.023	99.195
JR-MA-037-033	0.084	0.590	0.002	13.916	49.817	0.267	10.617	0.305	23.683	0.114	0.100	99.495	5.743	18.515	100.070
JR-MA-037-034	0.028	0.092	0.000	13.215	53.007	0.198	11.333	0.361	20.440	0.087	0.205	98.966	4.533	16.361	99.420
JR-MA-037-035	0.055	1.150	0.000	13.916	47.426	0.239	6.512	0.485	29.421	0.119	0.271	99.594	5.028	24.897	100.098
JR-MA-037-036	0.068	0.444	0.000	16.181	49.570	0.229	8.060	0.422	24.971	0.100	0.141	100.186	2.633	22.601	100.450
JR-MA-037-037	0.049	1.616	0.000	11.759	47.559	0.334	5.852	0.504	31.141	0.075	0.421	99.310	5.787	25.934	99.890
JR-MA-037-039	0.048	0.901	0.000	12.251	47.429	0.292	8.274	0.391	28.694	0.079	0.105	98.464	7.712	21.755	99.237
JR-MA-037-040	0.064	0.905	0.016	13.572	50.076	0.297	11.176	0.338	22.689	0.098	0.092	99.323	5.376	17.851	99.862
JR-MA-037-041	0.091	0.602	0.027	12.226	51.724	0.235	10.738	0.331	22.837	0.116	0.092	99.019	5.509	17.880	99.571
JR-MA-037-042	0.066	0.889	0.000	13.218	49.763	0.308	10.826	0.310	23.428	0.107	0.093	99.008	5.760	18.245	99.585
JR-MA-037-043	0.069	0.519	0.000	12.209	50.731	0.200	5.983	0.698	29.027	0.119	0.153	99.708	4.750	24.753	100.184
JR-MA-037-044	0.150	0.309	0.005	13.579	53.544	0.160	11.439	0.281	19.834	0.152	0.053	99.506	3.298	16.866	99.836
JR-MA-037-045	0.133	0.328	0.000	11.841	51.100	0.208	5.803	1.225	27.779	0.133	0.289	98.839	4.270	23.937	99.267
JR-MA-037-046	0.057	0.779	0.000	13.314	50.991	0.283	11.340	0.291	21.765	0.133	0.080	99.033	4.936	17.324	99.528
JR-MA-037-047	0.126	1.015	0.000	7.048	54.180	0.174	9.164	0.333	26.827	0.183	0.066	99.116	7.813	19.796	99.899
JR-MA-037-048	0.173	0.295	0.000	11.751	55.136	0.117	11.483	0.309	19.952	0.134	0.050	99.400	3.920	16.425	99.793
JR-MA-037-049	0.078	0.500	0.000	14.582	50.453	0.184	8.097	0.408	24.680	0.099	0.136	99.217	2.978	22.001	99.515

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-037-050	0.072	0.358	0.009	13.521	51.122	0.243	9.486	0.324	23.729	0.130	0.100	99.094	4.429	19.744	99.538
JR-MA-037-051	0.104	0.233	0.016	11.667	53.798	0.114	6.426	0.502	26.128	0.034	0.325	99.347	2.774	23.632	99.625
JR-MA-037-052	0.057	0.884	0.000	13.910	46.130	0.235	5.454	0.528	30.638	0.092	0.429	98.357	5.465	25.720	98.905
JR-MA-037-053	0.122	0.421	0.029	13.612	50.929	0.295	8.680	0.407	24.751	0.114	0.077	99.437	3.871	21.268	99.825
JR-MA-037-054	0.142	0.258	0.009	10.568	48.720	0.172	0.710	1.935	34.031	0.020	2.168	98.733	5.496	29.086	99.284
JR-MA-037-055	0.059	0.580	0.009	13.882	47.363	0.278	6.129	0.456	29.537	0.051	0.309	98.653	5.262	24.802	99.180
JR-MA-037-056	0.060	0.938	0.016	14.861	47.698	0.248	7.641	0.360	27.529	0.124	0.127	99.602	4.576	23.411	100.060
JR-MA-037-057	0.142	0.315	0.007	13.890	52.563	0.120	11.420	0.256	20.525	0.153	0.065	99.456	4.042	16.888	99.861
JR-MA-037-058	0.079	0.660	0.000	13.658	48.171	0.202	5.742	0.514	30.279	0.083	0.085	99.473	5.081	25.707	99.982
JR-MA-037-059	0.079	0.354	0.000	12.807	51.479	0.226	6.011	0.576	27.719	0.042	0.307	99.600	3.347	24.707	99.935
JR-MA-037-060	0.081	0.915	0.000	13.086	50.153	0.249	10.559	0.320	24.154	0.170	0.077	99.764	5.979	18.774	100.363
JR-MA-037-061	0.079	0.561	0.048	12.968	51.989	0.189	11.098	0.321	22.448	0.123	0.077	99.901	5.344	17.640	100.436
JR-MA-037-062	0.083	0.442	0.000	13.714	52.754	0.234	11.079	0.319	21.067	0.118	0.054	99.864	3.745	17.698	100.239
JR-MA-037-063	0.132	0.293	0.000	13.732	53.702	0.167	12.811	0.265	18.142	0.166	0.035	99.445	3.753	14.765	99.821
JR-MA-037-064	0.073	0.426	0.027	12.750	52.838	0.224	9.749	0.453	22.812	0.044	0.059	99.455	3.828	19.367	99.839
JR-MA-037-065	0.086	0.429	0.000	11.727	52.034	0.226	9.945	0.355	24.143	0.103	0.092	99.140	5.886	18.847	99.730
JR-MA-037-066	0.110	0.298	0.000	13.495	50.054	0.159	6.097	1.478	26.403	0.019	1.013	99.126	3.904	22.890	99.517
JR-MA-037-067	0.070	1.469	0.000	12.298	50.069	0.323	10.729	0.312	24.299	0.115	0.100	99.784	5.852	19.034	100.370
JR-MA-037-068	0.059	1.240	0.036	13.441	47.261	0.294	6.269	0.445	30.119	0.129	0.277	99.570	5.221	25.421	100.093
JR-MA-037-069	0.091	0.738	0.000	15.138	47.649	0.256	7.028	0.474	27.643	0.102	0.271	99.390	4.106	23.949	99.801
JR-MA-037-070	0.122	0.407	0.000	15.049	46.553	0.190	3.036	0.331	33.139	0.081	0.521	99.429	3.900	29.630	99.820
JR-MA-037-071	0.077	0.939	0.000	12.751	50.594	0.351	10.557	0.306	23.668	0.112	0.067	99.422	5.345	18.859	99.958
JR-MA-037-072	0.178	0.285	0.045	12.366	55.466	0.135	12.175	0.278	18.848	0.119	0.052	99.947	3.451	15.743	100.293
JR-MA-037-074	0.156	0.228	0.000	11.027	49.328	0.120	1.115	3.604	31.617	0.070	1.640	98.905	4.866	27.238	99.393
JR-MA-037-075	0.082	0.821	0.038	13.070	46.978	0.277	6.199	0.518	30.893	0.109	0.148	99.133	6.500	25.044	99.784
JR-MA-038-001	0.112	0.465	0.000	16.289	50.735	0.153	13.466	0.219	17.935	0.198	0.053	99.625	4.003	14.333	100.026
JR-MA-039-005	0.095	0.423	0.000	13.193	54.445	0.202	11.506	0.269	19.218	0.114	0.092	99.557	2.672	16.813	99.825
JR-MA-042-005	0.130	0.321	0.000	14.588	53.682	0.174	13.622	0.255	16.787	0.188	0.033	99.780	3.339	13.783	100.115
JR-MA-042-006	0.135	0.278	0.000	13.259	52.849	0.160	10.140	0.281	22.253	0.135	0.074	99.564	3.863	18.777	99.951
JR-MA-042-007	0.125	0.304	0.000	12.412	53.445	0.168	9.723	0.297	23.159	0.096	0.054	99.783	4.155	19.421	100.199
JR-MA-042-008	0.083	0.520	0.032	13.329	51.615	0.260	11.510	0.309	22.250	0.090	0.064	100.062	5.567	17.241	100.620
JR-MA-045-001	0.067	0.511	0.018	14.374	49.172	0.259	10.078	0.310	25.392	0.087	0.068	100.336	6.377	19.654	100.975
JR-MA-045-003	0.100	0.782	0.000	17.062	48.046	0.299	12.083	0.266	21.289	0.185	0.075	100.187	4.540	17.204	100.642
JR-MA-045-004	0.099	1.053	0.000	13.904	49.248	0.281	7.851	0.403	27.041	0.138	0.149	100.167	4.238	23.228	100.592
JR-MA-046-002	0.092	0.374	0.000	14.452	51.096	0.182	10.138	0.331	22.988	0.109	0.095	99.857	4.331	19.091	100.291
JR-MA-046-003	0.069	0.770	0.014	13.719	47.107	0.386	6.895	0.498	29.866	0.166	0.197	99.687	6.233	24.257	100.312
JR-MA-046-004	0.050	0.996	0.018	11.395	51.032	0.276	9.337	0.322	26.095	0.102	0.071	99.694	6.195	20.521	100.315
JR-MA-046-006	0.143	0.304	0.032	13.229	53.951	0.144	11.681	0.293	20.243	0.127	0.069	100.216	3.977	16.665	100.614
JR-MA-046-007	0.102	1.041	0.012	33.523	33.347	0.168	14.856	0.175	15.782	0.251	0.078	99.335	0.556	15.282	99.391

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-046-008	0.096	0.477	0.057	12.126	53.322	0.274	10.185	0.317	23.036	0.117	0.110	100.117	4.456	19.026	100.563
JR-MA-047-001	0.119	0.503	0.050	14.180	50.047	0.260	9.639	0.302	24.909	0.102	0.071	100.182	5.113	20.308	100.694
JR-MA-047-002	0.121	0.381	0.000	12.450	52.303	0.183	9.819	0.316	24.464	0.087	0.094	100.218	5.536	19.483	100.773
JR-MA-050-001	0.124	0.494	0.032	13.897	53.500	0.199	12.165	0.321	19.564	0.122	0.092	100.510	3.622	16.305	100.873
JR-MA-050-002	0.076	0.474	0.007	15.399	52.988	0.178	12.502	0.279	18.358	0.106	0.058	100.425	2.693	15.935	100.695
JR-MA-050-003	0.067	0.607	0.000	12.264	52.610	0.201	8.279	0.424	25.495	0.132	0.170	100.249	4.177	21.737	100.667
JR-MA-050-004	0.117	1.781	0.007	19.322	42.781	0.193	13.831	0.213	20.734	0.195	0.066	99.240	5.908	15.418	99.832
JR-MA-050-005	0.063	0.799	0.000	13.679	48.779	0.285	8.687	0.393	26.067	0.130	0.107	98.989	5.255	21.338	99.516
JR-MA-050-006	0.100	1.122	0.000	24.810	39.822	0.216	16.045	0.187	16.008	0.210	0.059	98.579	4.357	12.087	99.016
JR-MA-050-007	0.141	0.357	0.000	14.764	51.490	0.171	12.268	0.275	19.190	0.139	0.055	98.850	3.940	15.645	99.245
JR-MA-050-009	0.043	1.539	0.059	13.511	46.951	0.358	9.195	0.339	27.279	0.137	0.143	99.554	6.357	21.559	100.191
JR-MA-050-010	0.045	0.236	0.025	7.927	47.234	0.092	0.439	3.086	35.160	0.031	4.115	98.390	10.362	25.836	99.428
JR-MA-050-011	0.085	0.806	0.000	13.236	51.988	0.298	11.790	0.282	21.061	0.123	0.109	99.778	4.589	16.932	100.238
JR-MA-050-012	0.049	1.678	0.036	13.300	48.851	0.377	11.326	0.286	22.964	0.088	0.090	99.045	5.106	18.369	99.557
JR-MA-050-013	0.167	0.585	0.000	23.992	42.909	0.200	16.295	0.162	14.727	0.220	0.040	99.297	3.690	11.407	99.667
JR-MA-050-014	0.051	0.918	0.018	15.819	48.209	0.250	8.115	0.412	24.753	0.162	0.182	98.889	2.604	22.410	99.150
JR-MA-050-015	0.177	1.026	0.000	30.708	34.710	0.146	17.303	0.201	15.058	0.247	0.043	99.619	4.186	11.292	100.038
JR-MA-050-016	0.115	0.384	0.000	14.242	54.602	0.175	12.240	0.272	17.055	0.111	0.087	99.283	1.505	15.701	99.434
JR-MA-050-017	0.045	1.157	0.000	14.941	47.264	0.210	10.780	0.328	23.851	0.144	0.107	98.827	5.918	18.526	99.420
JR-MA-050-018	0.119	1.782	0.000	25.232	36.192	0.181	14.039	0.319	21.074	0.235	0.093	99.266	5.811	15.845	99.848
JR-MA-050-019	0.057	0.597	0.007	12.863	50.299	0.265	10.714	0.316	23.462	0.087	0.074	98.741	6.096	17.977	99.352
JR-MA-050-020	0.059	0.663	0.032	14.080	50.359	0.217	7.487	0.421	25.502	0.133	0.217	99.170	2.867	22.922	99.457
JR-MA-050-021	0.095	0.747	0.000	13.756	51.847	0.277	11.466	0.310	20.125	0.113	0.080	98.816	3.344	17.116	99.151
JR-MA-050-022	0.051	0.388	0.000	18.047	47.548	0.190	12.628	0.226	19.975	0.158	0.074	99.285	4.732	15.718	99.759
JR-MA-050-023	0.151	0.907	0.043	28.761	35.975	0.136	16.945	0.211	16.243	0.221	0.080	99.673	5.343	11.435	100.208
JR-MA-050-024	0.140	1.753	0.000	12.876	48.674	0.345	6.849	0.435	28.074	0.105	0.342	99.593	3.409	25.007	99.935
JR-MA-050-025	0.135	0.330	0.030	14.163	52.663	0.155	11.919	0.259	19.842	0.135	0.039	99.670	3.878	16.353	100.059
JR-MA-050-026	0.101	0.480	0.027	13.447	51.727	0.194	11.208	0.303	21.631	0.133	0.074	99.325	4.805	17.307	99.806
JR-MA-050-027	0.097	0.701	0.000	14.573	51.646	0.235	11.104	0.313	20.503	0.102	0.110	99.384	2.948	17.850	99.679
JR-MA-050-028	0.058	0.391	0.020	15.378	37.834	0.375	1.470	0.734	41.855	0.079	0.277	98.471	11.040	31.921	99.577
JR-MA-050-029	0.167	0.270	0.000	12.515	54.429	0.166	11.556	0.279	19.503	0.145	0.068	99.098	3.473	16.378	99.446
JR-MA-050-030	0.054	0.694	0.034	12.577	52.414	0.207	10.587	0.311	22.293	0.105	0.087	99.363	4.446	18.293	99.808
JR-MA-050-031	0.072	0.660	0.000	13.600	51.801	0.220	11.333	0.321	21.226	0.130	0.076	99.439	4.373	17.291	99.877
JR-MA-050-032	0.086	0.595	0.000	12.718	52.230	0.225	9.802	0.458	23.457	0.114	0.081	99.766	4.461	19.443	100.213
JR-MA-050-033	0.086	0.356	0.000	16.528	48.512	0.203	11.222	0.289	21.813	0.145	0.069	99.223	4.681	17.601	99.692
JR-MA-050-034	0.096	0.338	0.021	14.321	52.089	0.166	11.920	0.264	20.795	0.141	0.077	100.228	4.785	16.490	100.707
JR-MA-050-035	0.066	0.647	0.016	14.531	50.248	0.201	9.236	0.364	24.081	0.108	0.145	99.643	3.884	20.586	100.032
JR-MA-050-036	0.090	0.539	0.009	13.232	50.987	0.245	7.417	0.411	25.842	0.120	0.231	99.123	3.327	22.848	99.456
JR-MA-050-037	0.208	0.258	0.025	11.862	53.513	0.145	9.860	0.317	22.809	0.102	0.101	99.200	4.316	18.925	99.632

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-050-038	0.088	0.416	0.009	11.670	52.356	0.209	9.423	0.334	24.531	0.097	0.121	99.254	5.436	19.640	99.799
JR-MA-050-040	0.148	0.308	0.047	23.387	44.576	0.137	16.454	0.208	14.551	0.203	0.033	100.052	3.986	10.965	100.451
JR-MA-050-041	0.135	0.290	0.000	14.317	53.351	0.166	12.831	0.317	17.988	0.168	0.036	99.599	3.525	14.817	99.952
JR-MA-051-001	0.182	0.262	0.050	12.543	53.296	0.123	6.288	0.870	26.565	0.088	0.481	100.748	2.807	24.039	101.029
JR-MA-051-002	0.113	0.348	0.023	14.906	51.084	0.177	10.148	0.249	22.953	0.124	0.095	100.220	4.010	19.345	100.622
JR-MA-056-001	0.068	1.627	0.000	11.626	49.310	0.307	9.762	0.322	26.955	0.096	0.092	100.165	6.974	20.680	100.864
JR-MA-059-001	0.096	0.391	0.000	13.416	54.994	0.190	11.135	0.285	19.286	0.119	0.110	100.022	2.017	17.471	100.224
JR-MA-060-001	0.103	0.405	0.000	14.904	53.811	0.132	12.198	0.286	18.388	0.097	0.067	100.391	2.437	16.195	100.635
JR-MA-061-002	0.123	0.342	0.021	13.044	55.163	0.169	12.465	0.296	18.154	0.148	0.057	99.982	3.095	15.369	100.292
JR-MA-061-003	0.169	0.340	0.018	14.436	52.828	0.129	11.198	0.300	20.552	0.154	0.069	100.193	3.312	17.572	100.525
JR-MA-061-004	0.124	0.323	0.034	11.479	50.184	0.268	2.190	0.576	35.045	0.111	0.093	100.427	4.614	30.893	100.889
JR-MA-061-006	0.161	0.324	0.007	13.367	52.947	0.205	9.995	0.350	22.689	0.118	0.076	100.239	3.735	19.328	100.613
JR-MA-061-007	0.102	1.204	0.023	14.029	49.759	0.528	10.489	0.325	23.531	0.140	0.090	100.220	4.036	19.900	100.624
JR-MA-063-002	0.091	0.341	0.073	12.040	52.409	0.188	9.282	0.340	25.221	0.105	0.102	100.192	5.595	20.187	100.753
JR-MA-063-003	0.155	0.303	0.000	12.132	55.472	0.118	11.225	0.282	20.366	0.117	0.051	100.221	3.557	17.165	100.577
JR-MA-063-004	0.070	0.554	0.068	12.986	50.341	0.193	6.671	0.425	28.147	0.105	0.161	99.721	4.398	24.189	100.162
JR-MA-063-005	0.054	0.575	0.036	12.254	51.228	0.231	9.471	0.323	25.836	0.117	0.121	100.246	6.328	20.142	100.880
JR-MA-063-006	0.051	0.980	0.000	13.420	49.413	0.232	10.578	0.295	24.249	0.159	0.083	99.460	6.138	18.726	100.075
JR-MA-063-007	0.136	0.382	0.057	15.474	50.346	0.232	9.631	0.325	23.397	0.142	0.083	100.205	3.434	20.307	100.549
JR-MA-063-008	0.159	0.354	0.000	12.578	53.523	0.176	9.589	0.374	23.042	0.099	0.103	99.997	3.726	19.689	100.370
JR-MA-063-009	0.094	0.749	0.000	13.190	52.841	0.238	11.233	0.297	21.299	0.094	0.053	100.088	3.892	17.797	100.478
JR-MA-063-010	0.113	0.383	0.023	12.813	50.304	0.287	7.119	0.365	28.275	0.117	0.157	99.956	5.171	23.622	100.474
JR-MA-063-011	0.041	1.778	0.034	9.306	48.534	0.463	6.763	0.417	31.554	0.115	0.151	99.156	7.508	24.798	99.908
JR-MA-063-012	0.177	0.297	0.030	14.013	55.024	0.112	13.218	0.236	16.993	0.184	0.054	100.338	2.819	14.457	100.620
JR-MA-063-013	0.110	0.566	0.000	11.400	51.629	0.251	9.426	0.306	25.863	0.099	0.070	99.720	6.457	20.053	100.367
JR-MA-063-015	0.099	0.350	0.000	12.050	54.090	0.216	11.056	0.292	21.466	0.117	0.069	99.805	4.531	17.389	100.259
JR-MA-065-001	0.138	0.312	0.014	13.458	54.798	0.186	13.410	0.247	17.446	0.183	0.031	100.223	3.689	14.127	100.593
JR-MA-065-003	0.057	0.669	0.023	15.371	47.782	0.212	8.393	0.401	26.641	0.116	0.116	99.781	5.061	22.087	100.288
JR-MA-065-004	0.103	0.982	0.000	15.311	47.725	0.263	9.703	0.409	24.516	0.135	0.064	99.211	4.682	20.303	99.680
JR-MA-065-005	0.071	0.793	0.000	11.544	48.818	0.272	8.407	0.336	28.852	0.079	0.100	99.272	7.987	21.665	100.072
JR-MA-065-006	0.071	0.341	0.045	11.492	52.386	0.220	9.023	0.358	24.645	0.099	0.112	98.792	5.145	20.015	99.308
JR-MA-065-007	0.078	1.194	0.000	10.960	50.236	0.258	9.381	0.356	26.124	0.119	0.096	98.802	6.583	20.201	99.462
JR-MA-065-008	0.029	0.927	0.000	12.729	49.112	0.286	10.201	0.333	25.380	0.119	0.094	99.210	6.951	19.126	99.906
JR-MA-065-009	0.067	0.747	0.066	12.600	49.968	0.233	10.359	0.304	24.662	0.108	0.078	99.192	6.544	18.774	99.848
JR-MA-065-010	0.078	0.826	0.000	14.375	48.712	0.233	7.489	0.390	26.578	0.104	0.239	99.024	3.822	23.139	99.407
JR-MA-065-011	0.175	0.653	0.056	34.451	30.992	0.116	18.116	0.125	13.650	0.269	0.034	98.637	4.000	10.051	99.038
JR-MA-065-012	0.096	0.540	0.005	14.797	48.758	0.269	11.671	0.285	22.622	0.136	0.084	99.263	6.287	16.965	99.893
JR-MA-065-013	0.075	0.442	0.032	12.193	52.265	0.262	10.487	0.336	23.199	0.107	0.083	99.481	5.444	18.300	100.026
JR-MA-065-014	0.051	0.679	0.080	15.359	50.230	0.264	9.987	0.371	22.188	0.130	0.129	99.468	2.822	19.649	99.751

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-065-015	0.072	0.729	0.030	13.048	51.221	0.299	11.018	0.272	22.630	0.100	0.096	99.515	5.148	17.998	100.031
JR-MA-065-016	0.063	1.217	0.018	13.550	48.462	0.336	7.324	0.425	27.729	0.125	0.119	99.368	4.207	23.943	99.790
JR-MA-065-017	0.061	0.898	0.014	13.944	51.222	0.192	11.276	0.320	21.676	0.116	0.076	99.795	4.384	17.731	100.234
JR-MA-065-018	0.072	0.265	0.039	20.555	38.433	0.413	4.019	0.402	34.566	0.096	0.106	98.966	5.782	29.363	99.545
JR-MA-065-020	0.086	0.770	0.000	12.568	48.959	0.305	10.190	0.299	25.198	0.096	0.077	98.548	6.955	18.939	99.245
JR-MA-065-021	0.047	0.540	0.039	15.959	47.580	0.279	11.643	0.252	22.147	0.173	0.098	98.757	5.733	16.988	99.331
JR-MA-068-001	0.048	1.399	0.000	11.997	49.792	0.305	9.331	0.333	26.568	0.112	0.101	99.986	6.125	21.057	100.600
JR-MA-068-002	0.084	0.505	0.046	16.549	48.881	0.258	12.397	0.240	20.838	0.057	0.059	99.914	4.892	16.436	100.404
JR-MA-069-001	0.075	2.041	0.000	12.494	42.469	0.412	8.498	0.342	33.349	0.095	0.113	99.888	11.234	23.241	101.014
JR-MA-072-003	0.116	0.319	0.000	13.449	53.749	0.181	12.687	0.257	18.080	0.175	0.045	99.058	3.647	14.799	99.423
JR-MA-072-004	0.129	0.317	0.023	12.502	53.407	0.178	11.264	0.298	20.541	0.140	0.059	98.858	4.174	16.785	99.276
JR-MA-072-006	0.063	1.722	0.000	11.566	45.664	0.425	8.717	0.319	30.102	0.117	0.123	98.818	8.908	22.087	99.710
JR-MA-072-007	0.106	0.501	0.000	14.050	50.415	0.245	11.459	0.291	22.662	0.110	0.085	99.924	5.923	17.332	100.517
JR-MA-072-008	0.091	0.618	0.023	13.465	52.287	0.278	12.010	0.288	20.369	0.106	0.076	99.611	4.362	16.444	100.048
JR-MA-073-004	0.344	0.256	0.000	10.312	50.725	0.118	1.756	1.351	34.395	0.054	0.135	99.446	4.602	30.254	99.907
JR-MA-073-008	0.279	0.637	0.027	12.760	52.560	0.236	11.380	0.295	21.259	0.134	0.085	99.652	4.215	17.466	100.074
JR-MA-073-013	0.101	0.494	0.000	13.394	50.869	0.254	6.956	0.498	26.632	0.074	0.261	99.533	3.348	23.620	99.868
JR-MA-073-015	0.138	0.318	0.041	12.308	54.052	0.144	10.662	0.337	20.698	0.109	0.064	98.871	3.409	17.631	99.213
JR-MA-073-016	0.060	0.918	0.005	13.799	47.367	0.263	6.989	0.455	28.765	0.112	0.190	98.923	5.417	23.891	99.466
JR-MA-073-018	0.107	0.529	0.016	12.589	50.619	0.296	8.877	0.369	26.229	0.101	0.092	99.824	5.739	21.065	100.399
JR-MA-073-020	0.116	0.620	0.038	11.984	52.559	0.254	10.002	0.335	23.302	0.101	0.105	99.416	4.594	19.169	99.876
JR-MA-073-021	0.173	0.989	0.000	27.870	35.161	0.145	15.987	0.183	17.251	0.219	0.053	98.031	5.429	12.366	98.575
JR-MA-073-023	0.075	1.027	0.056	13.158	47.284	0.295	5.521	0.468	30.954	0.111	0.120	99.069	5.119	26.348	99.582
JR-MA-073-025	0.178	0.293	0.000	13.622	54.167	0.130	12.638	0.279	17.280	0.146	0.081	98.814	2.801	14.759	99.095
JR-MA-076-004	0.098	0.739	0.000	15.025	46.649	0.239	7.187	0.422	28.050	0.124	0.129	98.662	4.931	23.613	99.156
JR-MA-076-005	0.163	1.161	0.014	30.786	33.791	0.141	13.849	0.172	16.546	0.249	0.068	96.940	0.841	15.790	97.024
JR-MA-076-007	0.051	0.951	0.000	13.398	47.167	0.275	9.718	0.303	26.422	0.129	0.081	98.495	7.345	19.813	99.231
JR-MA-076-008	0.077	2.271	0.000	11.814	42.617	0.468	7.944	0.347	32.947	0.119	0.122	98.726	10.110	23.850	99.739
JR-MA-076-009	0.091	0.433	0.059	14.581	53.035	0.219	11.761	0.298	18.584	0.121	0.027	99.209	2.169	16.633	99.426
JR-MA-076-C10	0.042	1.457	0.000	12.187	48.814	0.272	10.018	0.288	25.768	0.134	0.107	99.087	6.669	19.767	99.755
JR-MA-076-011	0.041	1.214	0.000	12.652	47.562	0.318	5.733	0.488	30.432	0.106	0.325	98.871	5.167	25.783	99.389
JR-MA-076-013	0.069	0.380	0.052	14.184	54.452	0.179	12.957	0.269	16.461	0.092	0.048	99.143	2.059	14.609	99.349
JR-MA-076-014	0.107	0.407	0.027	11.894	52.208	0.224	8.791	0.376	25.036	0.104	0.113	99.287	4.864	20.659	99.774
JR-MA-076-015	0.077	1.902	0.000	14.970	45.850	0.402	11.312	0.298	23.431	0.178	0.159	98.579	5.382	18.588	99.118
JR-MA-076-016	0.085	0.480	0.000	13.987	51.941	0.170	9.795	0.393	21.858	0.125	0.103	98.937	2.947	19.206	99.232
JR-MA-076-018	0.101	0.371	0.000	14.050	48.142	0.208	5.816	0.473	29.466	0.102	0.364	99.093	4.881	25.074	99.582
JR-MA-076-019	0.083	1.246	0.025	12.259	47.051	0.343	4.658	0.505	33.002	0.070	0.393	99.635	5.864	27.725	100.223
JR-MA-076-020	0.102	1.028	0.000	13.873	46.572	0.318	6.002	0.478	30.969	0.128	0.285	99.755	5.751	25.795	100.331
JR-MA-076-021	0.096	0.412	0.000	11.401	53.132	0.263	9.381	0.341	24.760	0.121	0.097	100.004	5.319	19.974	100.537

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-076-022	0.065	0.723	0.000	13.969	51.858	0.186	11.025	0.302	20.985	0.114	0.097	99.324	3.561	17.780	99.681
JR-MA-076-023	0.106	0.377	0.054	14.441	50.555	0.194	10.206	0.300	23.357	0.083	0.077	99.750	4.707	19.122	100.222
JR-MA-076-025	0.076	0.737	0.023	15.995	48.014	0.271	9.921	0.307	23.913	0.099	0.102	99.458	4.313	20.032	99.890
JR-MA-076-026	0.055	0.503	0.016	13.968	48.316	0.281	9.502	0.295	25.892	0.059	0.123	99.010	6.494	20.049	99.661
JR-MA-076-027	0.079	0.704	0.018	9.997	54.029	0.297	7.525	0.485	26.254	0.127	0.133	99.648	4.076	22.586	100.056
JR-MA-076-028	0.064	0.574	0.032	15.405	49.356	0.184	7.700	0.381	25.965	0.109	0.124	99.894	3.220	23.067	100.217
JR-MA-076-029	0.039	1.272	0.000	13.609	47.348	0.256	6.699	0.500	29.289	0.090	0.167	99.269	5.118	24.684	99.782
JR-MA-077-001	0.091	0.729	0.000	13.034	50.401	0.274	7.128	0.478	28.068	0.098	0.144	100.445	4.580	23.947	100.904
JR-MA-077-002	0.108	1.735	0.000	26.509	36.339	0.143	15.204	0.197	19.637	0.196	0.086	100.154	5.602	14.596	100.715
JR-MA-077-004	0.101	0.464	0.014	14.093	54.815	0.198	12.926	0.284	16.272	0.114	0.078	99.359	1.690	14.751	99.528
JR-MA-077-005	0.080	0.778	0.018	14.656	48.178	0.276	10.844	0.288	23.863	0.146	0.106	99.233	6.093	18.380	99.844
JR-MA-077-006	0.153	0.375	0.000	14.595	52.909	0.156	13.714	0.232	17.459	0.161	0.040	99.794	4.117	13.754	100.207
JR-MA-077-007	0.076	0.415	0.000	14.601	51.938	0.209	10.573	0.319	21.620	0.113	0.123	99.987	3.450	18.516	100.333
JR-MA-077-008	0.062	1.913	0.018	12.195	47.807	0.402	8.889	0.366	27.560	0.099	0.133	99.444	5.971	22.188	100.042
JR-MA-077-009	0.145	0.352	0.000	12.689	52.851	0.179	10.714	0.328	21.986	0.120	0.092	99.456	4.601	17.846	99.917
JR-MA-077-010	0.033	2.229	0.016	12.422	45.266	0.333	5.308	0.500	32.985	0.211	0.238	99.541	6.057	27.535	100.148
JR-MA-077-011	0.154	0.368	0.000	12.423	53.467	0.211	11.369	0.296	20.856	0.136	0.046	99.326	4.406	16.892	99.767
JR-MA-077-012	0.202	1.116	0.000	30.788	32.784	0.136	16.444	0.212	18.145	0.249	0.051	100.127	5.843	12.888	100.712
JR-MA-077-013	0.193	0.433	0.000	36.406	29.606	0.100	17.986	0.152	13.791	0.264	0.060	98.991	3.803	10.369	99.372
JR-MA-077-014	0.064	0.487	0.009	15.248	49.598	0.275	11.784	0.287	22.265	0.116	0.095	100.228	5.746	17.095	100.804
JR-MA-077-016	0.074	0.529	0.000	14.671	48.397	0.251	7.640	0.445	27.615	0.103	0.124	99.849	5.076	23.047	100.358
JR-MA-077-018	0.068	1.244	0.014	12.008	50.901	0.315	9.646	0.313	24.514	0.137	0.118	99.278	4.770	20.222	99.756
JR-MA-077-019	0.063	1.187	0.000	13.217	50.291	0.272	10.405	0.346	22.826	0.127	0.090	98.824	4.295	18.961	99.254
JR-MA-077-020	0.043	1.966	0.000	12.429	46.483	0.392	6.577	0.509	30.145	0.200	0.151	98.895	5.374	25.309	99.433
JR-MA-077-021	0.054	0.915	0.000	15.357	49.644	0.291	12.401	0.311	19.797	0.135	0.076	98.981	4.105	16.103	99.392
JR-MA-077-022	0.087	0.660	0.014	13.407	50.408	0.207	6.817	0.502	27.116	0.119	0.177	99.514	3.538	23.933	99.868
JR-MA-077-024	0.113	0.504	0.000	13.114	51.590	0.176	8.273	0.370	24.464	0.111	0.102	98.817	3.325	21.472	99.150
JR-MA-078-002	1.386	0.763	0.013	11.195	48.093	0.262	4.779	0.764	31.518	0.091	0.118	98.982	3.662	28.223	99.349
JR-MA-078-003	0.067	0.931	0.000	11.948	51.482	0.282	9.706	0.294	24.969	0.120	0.116	99.915	5.492	20.027	100.465
JR-MA-078-004	0.411	0.926	0.000	13.301	49.360	0.386	11.250	0.292	22.668	0.112	0.092	98.798	5.024	18.148	99.301
JR-MA-078-005	0.153	0.412	0.007	15.242	52.091	0.126	13.283	0.268	18.066	0.169	0.061	99.878	3.995	14.471	100.278
JR-MA-078-006	0.059	0.871	0.000	12.882	49.812	0.231	6.809	0.463	27.309	0.110	0.231	98.777	3.892	23.807	99.167
JR-MA-078-007	0.078	0.474	0.034	13.634	49.373	0.228	8.051	0.467	26.949	0.097	0.276	99.661	5.503	21.998	100.212
JR-MA-078-008	0.064	0.554	0.000	11.330	49.998	0.224	8.065	0.362	28.474	0.071	0.104	99.246	7.400	21.816	99.987
JR-MA-078-010	0.151	0.297	0.013	12.180	53.888	0.151	8.085	0.302	24.293	0.093	0.094	99.547	2.806	21.768	99.828
JR-MA-078-011	0.087	0.299	0.000	16.294	49.689	0.380	9.209	0.397	22.806	0.114	0.119	99.394	2.273	20.761	99.622
JR-MA-078-012	0.094	1.087	0.000	15.060	49.730	0.388	12.449	0.269	19.835	0.171	0.087	99.170	3.824	16.394	99.553
JR-MA-078-013	0.049	0.569	0.022	9.978	50.139	0.276	3.528	0.670	33.692	0.076	0.214	99.213	6.108	28.196	99.825
JR-MA-078-014	0.069	0.915	0.000	17.470	46.288	0.290	12.231	0.279	21.360	0.187	0.079	99.168	5.101	16.770	99.679

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-078-015	0.065	0.618	0.036	11.971	50.829	0.246	6.508	0.536	28.120	0.123	0.140	99.192	4.464	24.103	99.639
JR-MA-078-016	0.084	1.517	0.000	9.800	49.998	0.303	7.797	0.344	29.378	0.102	0.136	99.459	7.063	23.022	100.167
JR-MA-078-018	0.110	0.428	0.088	12.443	53.116	0.237	10.040	0.292	23.008	0.115	0.104	99.981	4.200	19.229	100.402
JR-MA-078-019	0.077	1.280	0.000	14.168	46.315	0.307	5.957	0.456	31.001	0.129	0.290	99.980	5.369	26.170	100.518
JR-MA-078-020	0.065	0.410	0.052	11.430	50.457	0.237	4.839	0.653	31.350	0.110	0.469	100.072	5.634	26.281	100.636
JR-MA-078-021	0.075	0.717	0.009	13.882	50.356	0.190	7.986	0.393	26.224	0.125	0.088	100.045	4.042	22.587	100.450
JR-MA-078-022	0.085	1.183	0.016	10.213	48.545	0.304	6.978	0.446	30.931	0.114	0.117	98.932	7.917	23.807	99.725
JR-MA-079-001	0.133	0.246	0.011	13.642	57.163	0.129	11.975	0.311	16.303	0.076	0.104	100.093	0.261	16.068	100.119
JR-MA-080-003	0.064	2.013	0.000	9.887	48.231	0.358	8.316	0.363	29.759	0.140	0.098	99.229	7.883	22.666	100.019
JR-MA-080-005	0.064	1.086	0.000	10.961	51.808	0.263	7.448	0.437	27.484	0.104	0.139	99.794	4.724	23.233	100.267
JR-MA-080-006	0.080	0.976	0.011	14.922	48.929	0.196	9.444	0.376	25.093	0.149	0.093	100.269	4.724	20.842	100.742
JR-MA-080-007	0.065	0.489	0.000	14.296	47.651	0.188	5.800	0.404	30.043	0.102	0.218	99.256	5.131	25.426	99.770
JR-MA-080-008	0.073	0.553	0.000	11.973	51.302	0.260	9.536	0.290	25.300	0.112	0.109	99.508	6.088	19.822	100.118
JR-MA-080-009	0.075	1.039	0.000	15.434	47.243	0.311	7.191	0.405	28.029	0.124	0.168	100.019	4.005	24.425	100.420
JR-MA-080-010	0.190	0.420	0.052	12.713	53.406	0.248	11.322	0.309	20.585	0.134	0.098	99.477	3.774	17.190	99.855
JR-MA-080-011	0.172	0.373	0.000	7.711	60.151	0.102	12.761	0.255	17.567	0.121	0.071	99.284	4.087	13.890	99.693
JR-MA-080-013	0.180	1.327	0.000	28.436	35.566	0.108	16.585	0.179	16.960	0.235	0.037	99.613	5.176	12.302	100.132
JR-MA-080-014	0.091	0.581	0.000	14.843	50.129	0.310	11.180	0.279	22.088	0.095	0.038	99.634	4.552	17.992	100.090
JR-MA-080-015	0.066	0.592	0.000	14.958	49.607	0.205	10.732	0.318	22.179	0.131	0.079	98.867	4.477	18.150	99.316
JR-MA-080-017	0.088	0.765	0.000	13.439	50.299	0.211	10.775	0.262	23.162	0.089	0.061	99.151	5.448	18.260	99.697
JR-MA-080-018	0.089	0.611	0.009	14.785	48.430	0.204	7.625	0.431	26.540	0.091	0.163	98.978	4.143	22.812	99.393
JR-MA-080-019	0.063	0.746	0.000	12.067	47.232	0.335	4.717	0.534	32.942	0.092	0.362	99.090	6.705	26.909	99.762
JR-MA-080-021	0.066	1.045	0.014	13.052	48.592	0.317	5.911	0.553	29.327	0.108	0.229	99.214	4.164	25.580	99.631
JR-MA-080-022	0.086	0.708	0.002	13.672	50.678	0.217	7.760	0.385	25.726	0.115	0.146	99.495	3.343	22.718	99.830
JR-MA-081-001	0.040	1.000	0.056	12.064	49.508	0.343	8.718	0.327	26.689	0.130	0.094	98.969	5.863	21.414	99.556
JR-MA-081-002	0.069	0.989	0.000	13.199	47.986	0.252	5.610	0.487	30.373	0.124	0.178	99.267	4.828	26.029	99.751
JR-MA-081-003	0.083	1.536	0.020	13.394	49.065	0.227	6.573	0.472	27.319	0.046	0.475	99.210	2.754	24.841	99.486
JR-MA-081-005	0.101	1.022	0.047	11.477	51.726	0.322	9.644	0.358	23.983	0.136	0.136	98.952	4.583	19.859	99.411
JR-MA-081-006	0.097	0.980	0.009	10.638	51.026	0.289	9.126	0.328	25.709	0.108	0.133	98.443	6.001	20.309	99.044
JR-MA-081-008	0.060	0.762	0.011	14.783	48.060	0.208	7.176	0.432	28.064	0.112	0.136	99.804	4.647	23.882	100.270
JR-MA-081-009	0.094	1.458	0.040	12.191	44.744	0.333	4.526	0.556	34.682	0.107	0.301	99.032	7.480	27.952	99.781
JR-MA-081-011	0.135	0.337	0.025	12.151	51.694	0.175	7.020	0.372	27.592	0.068	0.178	99.747	4.626	23.429	100.211
JR-MA-081-012	0.071	0.489	0.000	12.068	51.402	0.201	5.811	0.518	29.102	0.080	0.178	99.920	4.305	25.228	100.351
JR-MA-082-003	0.067	0.970	0.014	13.617	47.291	0.240	5.922	0.446	30.196	0.112	0.260	99.135	5.182	25.533	99.654
JR-MA-083-001	0.111	0.489	0.023	10.741	55.062	0.120	12.932	0.265	20.142	0.164	0.072	100.121	6.343	14.434	100.757
JR-MA-083-002	0.109	0.464	0.000	13.918	52.020	0.179	7.808	0.507	24.421	0.110	0.148	99.684	2.296	22.355	99.914
JR-MA-083-003	0.089	1.183	0.023	13.160	47.725	0.387	9.992	0.335	26.522	0.106	0.085	99.607	7.081	20.150	100.317
JR-MA-083-004	0.096	0.277	0.000	9.279	58.322	0.217	9.974	0.377	21.184	0.085	0.083	99.894	3.009	18.476	100.196
JR-MA-083-005	0.067	1.585	0.000	12.039	48.268	0.376	10.028	0.311	26.520	0.129	0.106	99.429	7.093	20.138	100.140

Appendix E. Chromites

Sample	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO^*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
JR-MA-083-006	0.089	1.108	0.027	10.411	47.553	0.268	3.940	0.600	35.009	0.078	0.302	99.385	7.534	28.230	100.140
JR-MA-083-007	0.161	0.316	0.036	13.822	54.795	0.118	14.231	0.208	15.471	0.203	0.027	99.388	3.165	12.623	99.705
JR-MA-083-008	0.056	1.475	0.038	12.756	49.257	0.443	10.653	0.348	24.130	0.147	0.126	99.429	5.456	19.221	99.976
JR-MA-083-009	0.106	0.534	0.009	12.918	51.499	0.225	9.563	0.364	24.233	0.140	0.038	99.629	4.825	19.891	100.112
JR-MA-083-010	0.049	0.531	0.000	13.550	50.887	0.208	8.507	0.452	24.852	0.144	0.132	99.312	4.057	21.202	99.718
JR-MA-083-011	0.071	1.174	0.000	13.465	49.694	0.317	10.622	0.315	23.776	0.158	0.081	99.673	5.269	19.035	100.201
JR-MA-083-012	0.065	0.798	0.050	14.663	50.461	0.191	9.225	0.367	24.096	0.139	0.066	100.121	3.483	20.962	100.470
JR-MA-083-013	0.176	0.766	0.000	29.102	37.033	0.132	16.750	0.198	15.470	0.241	0.063	99.931	4.170	11.718	100.349
JR-MA-083-015	0.066	1.894	0.002	11.498	45.274	0.350	3.929	0.552	35.388	0.144	0.447	99.544	6.997	29.092	100.245
JR-MA-083-016	0.116	0.367	0.000	11.763	52.229	0.252	9.288	0.317	25.368	0.092	0.119	99.911	5.796	20.152	100.492
JR-MA-083-017	0.060	0.811	0.023	13.782	47.958	0.298	8.945	0.366	27.225	0.098	0.136	99.702	6.594	21.292	100.363
JR-MA-083-020	0.077	0.695	0.011	11.307	51.120	0.266	6.155	0.512	28.900	0.086	0.107	99.236	4.625	24.738	99.699
JR-MA-083-021	0.088	0.582	0.000	13.438	46.568	0.338	6.045	0.562	31.586	0.138	0.157	99.502	7.058	25.235	100.209
JR-MA-084-001	0.187	0.283	0.000	13.267	55.076	0.102	13.080	0.250	17.372	0.166	0.031	99.814	3.335	14.372	100.148
JR-MA-084-002	0.067	1.534	0.063	13.196	47.266	0.374	6.128	0.472	30.468	0.158	0.283	100.009	4.857	26.098	100.496
JR-MA-084-003	0.086	0.775	0.023	16.525	48.843	0.286	12.520	0.285	20.609	0.184	0.074	100.210	4.656	16.419	100.677
JR-MA-084-004	0.162	0.977	0.000	29.677	35.024	0.136	16.636	0.177	15.946	0.265	0.054	99.054	4.506	11.891	99.505
JR-MA-084-005	0.063	0.986	0.032	13.950	48.310	0.266	6.348	0.510	28.653	0.116	0.175	99.409	3.973	25.078	99.807
JR-MA-084-009	0.058	0.873	0.034	11.960	50.372	0.334	9.626	0.322	26.284	0.097	0.091	100.051	6.671	20.282	100.719
JR-MA-084-010	0.083	0.505	0.014	14.650	52.387	0.173	10.932	0.337	20.312	0.143	0.072	99.608	2.695	17.887	99.878
JR-MA-084-011	0.085	0.644	0.009	15.072	47.652	0.272	7.415	0.485	27.627	0.087	0.155	99.503	4.650	23.443	99.969
JR-MA-084-012	0.074	0.536	0.000	16.539	50.259	0.161	10.793	0.337	20.627	0.111	0.079	99.516	2.505	18.373	99.767
JR-MA-084-013	0.101	0.388	0.002	12.401	52.922	0.215	10.838	0.288	21.836	0.111	0.068	99.170	4.680	17.625	99.639
JR-MA-084-014	0.124	1.053	0.036	13.380	48.795	0.252	6.665	0.469	28.013	0.123	0.253	99.163	3.896	24.507	99.553
JR-MA-084-015	0.061	0.724	0.000	14.502	48.704	0.277	7.183	0.420	26.958	0.109	0.207	99.145	3.717	23.614	99.517
JR-MA-084-016	0.085	0.254	0.002	14.573	50.146	0.237	10.597	0.320	22.881	0.127	0.084	99.306	5.182	18.218	99.825
JR-MA-084-017	0.134	1.756	0.000	24.858	36.111	0.182	14.727	0.201	20.815	0.198	0.047	99.029	6.612	14.866	99.691
JR-MA-084-018	0.061	1.593	0.000	12.323	48.243	0.346	6.042	0.528	30.095	0.091	0.359	99.681	4.702	25.864	100.152
JR-MA-084-019	0.105	1.056	0.000	11.816	48.645	0.238	5.240	0.517	31.017	0.112	0.256	99.002	5.249	26.294	99.528
JR-MA-084-020	0.059	0.904	0.052	14.094	49.169	0.271	8.007	0.413	26.580	0.149	0.143	99.841	4.259	22.747	100.268
JR-MA-084-021	0.072	0.438	0.005	14.195	49.447	0.225	6.194	0.448	28.687	0.071	0.264	100.046	4.084	25.012	100.455
JR-MA-084-022	0.070	0.720	0.000	16.292	48.529	0.238	10.116	0.369	23.026	0.116	0.093	99.569	3.764	19.639	99.946
JR-MA-084-023	0.149	0.289	0.000	12.505	53.135	0.198	8.905	0.306	23.775	0.108	0.102	99.472	3.554	20.577	99.828
JR-MA-084-024	0.056	1.150	0.002	14.659	44.847	0.256	6.053	0.466	31.323	0.139	0.239	99.190	6.286	25.667	99.820
JR-MA-084-025	0.092	0.714	0.025	14.464	50.766	0.164	9.037	0.358	24.085	0.116	0.091	99.912	3.371	21.052	100.250
JR-MA-084-026	0.083	0.793	0.034	14.044	45.509	0.260	5.539	0.461	32.378	0.110	0.230	99.441	6.823	26.239	100.125
JR-MA-084-027	0.089	1.075	0.036	12.846	48.479	0.312	6.036	0.530	29.805	0.137	0.256	99.601	4.750	25.531	100.077
JR-MA-084-028	0.181	0.922	0.029	31.554	32.577	0.116	16.750	0.182	16.805	0.236	0.058	99.410	5.195	12.130	99.931
JR-MA-084-029	0.232	0.819	0.000	14.472	51.805	0.220	12.381	0.241	19.332	0.158	0.067	99.727	3.355	16.313	100.063

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-086-001	0.039	1.242	0.000	12.247	48.781	0.337	5.532	0.491	31.010	0.112	0.227	100.018	4.984	26.525	100.517
JR-MA-086-002	0.092	0.404	0.032	11.606	52.175	0.185	9.192	0.319	24.746	0.085	0.115	98.951	5.389	19.897	99.491
JR-MA-086-003	0.072	0.713	0.002	12.310	52.069	0.293	9.519	0.312	24.173	0.098	0.118	99.679	4.516	20.109	100.131
JR-MA-088-003	0.053	0.480	0.000	13.358	50.305	0.258	10.428	0.260	22.605	0.143	0.112	98.002	5.033	18.076	98.506
JR-MA-088-004	0.130	1.046	0.000	6.910	50.791	0.170	1.910	2.909	34.549	0.162	0.322	98.899	7.261	28.015	99.627
JR-MA-088-006	0.077	1.280	0.036	12.038	49.690	0.332	9.336	0.332	26.083	0.123	0.123	99.450	5.809	20.856	100.032
JR-MA-088-007	0.101	1.235	0.000	7.971	51.951	0.234	9.473	0.339	27.691	0.220	0.042	99.257	8.803	19.770	100.139
JR-MA-088-008	0.056	0.126	0.039	20.966	37.110	0.391	4.058	0.472	36.029	0.099	0.247	99.593	7.572	29.216	100.352
JR-MA-088-009	0.086	0.335	0.000	11.848	51.381	0.228	7.280	0.433	28.284	0.090	0.184	100.149	5.831	23.037	100.733
JR-MA-088-010	0.144	0.352	0.009	14.304	55.087	0.220	15.759	0.180	13.656	0.201	0.026	99.938	3.272	10.712	100.266
JR-MA-088-011	0.046	1.419	0.054	12.573	47.303	0.314	9.183	0.342	28.377	0.072	0.129	99.812	7.720	21.431	100.585
JR-MA-091-002	0.081	0.159	0.000	12.012	52.301	0.144	6.135	0.559	27.546	0.030	0.521	99.488	4.053	23.899	99.894
JR-MA-091-003	0.053	0.251	0.000	20.465	47.430	0.230	13.387	0.272	17.730	0.132	0.155	100.105	3.015	15.017	100.407
JR-MA-094-002	0.095	0.918	0.000	12.104	50.355	0.254	9.437	0.306	25.122	0.142	0.118	98.851	5.615	20.070	99.414
JR-MA-094-019	0.089	0.755	0.007	15.428	49.093	0.201	8.571	0.369	24.607	0.131	0.136	99.387	3.174	21.751	99.705
JR-MA-094-020	0.066	0.601	0.050	12.809	51.099	0.209	9.139	0.392	24.247	0.118	0.085	98.815	4.466	20.229	99.262
JR-MA-094-021	0.089	0.325	0.000	11.868	54.378	0.154	10.517	0.304	21.295	0.116	0.062	99.108	3.869	17.814	99.496
JR-MA-094-022	0.158	0.869	0.007	9.770	48.940	0.206	5.674	2.206	30.591	0.057	0.211	98.689	7.881	23.500	99.479
JR-MA-094-023	0.075	0.681	0.007	12.951	52.329	0.242	11.014	0.300	21.351	0.119	0.074	99.143	4.086	17.675	99.552
JR-MA-094-025	0.064	0.615	0.052	12.351	49.250	0.146	4.247	0.597	31.564	0.090	0.178	99.154	4.621	27.406	99.617
JR-MA-094-026	0.091	0.406	0.061	11.612	53.093	0.211	9.483	0.374	23.847	0.122	0.087	99.387	4.737	19.584	99.862
JR-MA-094-027	0.150	0.321	0.027	12.021	53.730	0.151	9.677	0.722	22.102	0.150	0.048	99.099	3.699	18.774	99.470
JR-MA-094-028	0.113	0.481	0.020	11.409	52.098	0.220	9.230	0.369	25.248	0.093	0.095	99.376	5.777	20.050	99.955
JR-MA-094-029	0.185	0.253	0.034	12.476	50.962	0.147	3.388	0.423	31.079	0.119	0.426	99.492	2.806	28.554	99.773
JR-MA-094-030	0.067	1.280	0.013	10.251	46.735	0.347	3.218	0.864	36.090	0.088	0.297	99.250	7.621	29.232	100.014
JR-MA-094-031	0.103	0.469	0.000	14.855	49.296	0.202	8.125	0.496	25.345	0.079	0.160	99.130	3.798	21.928	99.510
JR-MA-094-032	0.067	1.580	0.014	12.825	48.081	0.369	10.147	0.345	25.810	0.181	0.094	99.513	6.435	20.020	100.158
JR-MA-094-033	0.064	0.964	0.000	14.235	48.270	0.226	7.041	0.449	27.865	0.143	0.168	99.425	4.293	24.003	99.855
JR-MA-094-034	0.074	0.981	0.018	14.090	45.289	0.234	5.861	0.462	31.540	0.102	0.157	98.808	6.468	25.720	99.456
JR-MA-094-035	0.090	0.247	0.000	13.821	52.247	0.136	6.923	0.503	25.434	0.038	0.424	99.863	2.386	23.287	100.102
JR-MA-094-036	0.074	0.848	0.000	13.192	50.584	0.291	10.887	0.330	22.909	0.129	0.090	99.334	5.286	18.152	99.864
JR-MA-094-037	0.071	0.606	0.000	15.302	50.963	0.224	10.975	0.394	20.672	0.148	0.077	99.432	3.028	17.947	99.735
JR-MA-094-038	0.065	0.617	0.018	14.206	47.703	0.229	2.565	0.661	33.054	0.078	0.263	99.459	3.045	30.314	99.764
JR-MA-094-039	0.172	0.347	0.000	14.900	52.180	0.198	11.699	0.284	19.714	0.126	0.071	99.691	3.176	16.857	100.009
JR-MA-094-040	0.058	0.704	0.000	13.168	45.521	0.229	2.806	1.627	34.138	0.127	0.482	98.860	6.298	28.471	99.491
JR-MA-094-041	0.153	0.290	0.020	13.974	55.616	0.199	13.507	0.245	15.778	0.067	0.059	99.908	1.927	14.044	100.101
JR-MA-094-042	0.078	0.304	0.040	11.326	52.868	0.173	9.110	0.411	25.118	0.092	0.129	99.649	5.715	19.976	100.222
JR-MA-094-043	0.130	0.035	0.005	11.981	58.623	0.213	13.644	0.271	14.528	0.104	0.073	99.607	1.598	13.090	99.767
JR-MA-094-044	0.070	0.468	0.000	16.307	47.796	0.167	11.628	0.347	22.788	0.140	0.118	99.829	6.331	17.091	100.463

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-095-006	0.071	1.506	0.000	13.018	49.615	0.375	11.145	0.302	23.090	0.159	0.108	99.389	5.160	18.447	99.906
JR-MA-095-007	0.126	0.435	0.043	14.336	53.003	0.164	11.403	0.311	19.358	0.096	0.086	99.361	2.510	17.100	99.612
JR-MA-095-008	0.103	0.902	0.029	13.587	49.341	0.249	7.683	0.436	26.802	0.119	0.104	99.355	4.173	23.047	99.773
JR-MA-095-009	0.083	0.910	0.041	13.178	50.594	0.251	11.216	0.331	22.600	0.124	0.070	99.398	5.405	17.736	99.940
JR-MA-095-010	0.096	0.756	0.032	14.912	51.022	0.218	10.713	0.333	21.495	0.133	0.098	99.808	3.156	18.655	100.124
JR-MA-095-012	0.076	0.501	0.000	13.281	50.465	0.229	6.675	0.452	27.515	0.109	0.141	99.444	3.829	24.069	99.828
JR-MA-095-013	0.163	0.370	0.000	12.484	51.558	0.174	7.318	0.679	26.286	0.100	0.093	99.225	4.067	22.627	99.632
JR-MA-095-014	0.075	0.574	0.018	10.584	53.966	0.221	6.163	0.544	26.874	0.039	0.097	99.155	2.747	24.402	99.430
JR-MA-095-015	0.079	0.931	0.014	14.055	48.986	0.247	8.353	0.454	26.323	0.122	0.091	99.655	4.619	22.167	100.118
JR-MA-095-017	0.160	0.293	0.039	14.081	52.839	0.151	12.174	0.276	18.957	0.131	0.045	99.146	3.554	15.759	99.502
JR-MA-095-018	0.185	0.269	0.007	12.012	54.892	0.146	10.243	0.329	21.183	0.115	0.062	99.443	3.098	18.396	99.753
JR-MA-095-019	0.128	0.271	0.016	13.921	51.642	0.144	7.838	0.869	24.720	0.025	0.204	99.778	3.208	21.833	100.099
JR-MA-095-020	0.185	0.579	0.027	14.075	52.210	0.254	11.205	0.310	20.602	0.125	0.074	99.646	3.138	17.779	99.960
JR-MA-095-021	0.131	0.453	0.002	12.585	52.224	0.264	10.259	0.297	22.962	0.098	0.083	99.358	4.665	18.764	99.825
JR-MA-095-022	0.071	1.130	0.041	13.299	49.012	0.291	10.666	0.280	24.035	0.143	0.101	99.069	5.875	18.749	99.658
JR-MA-095-023	0.039	1.767	0.000	10.413	45.935	0.359	4.280	0.563	35.046	0.175	0.270	98.847	7.658	28.155	99.614
JR-MA-095-025	0.170	0.318	0.000	11.524	54.328	0.131	8.582	1.138	22.658	0.174	0.124	99.147	3.141	19.831	99.462
JR-MA-095-026	0.063	0.484	0.023	15.184	50.390	0.232	10.820	0.309	21.254	0.123	0.128	99.010	3.597	18.017	99.370
JR-MA-095-027	0.116	0.346	0.045	12.540	47.554	0.166	0.914	0.452	36.530	0.082	0.639	99.384	4.817	32.196	99.867
JR-MA-095-028	0.127	0.345	0.000	14.352	52.016	0.160	11.718	0.260	19.579	0.[illegible]19	0.056	98.732	3.572	16.365	99.090
JR-MA-095-029	0.080	0.902	0.038	12.905	50.346	0.246	10.407	0.328	23.528	0.113	0.080	98.973	5.281	18.776	99.502
JR-MA-095-030	0.084	0.487	0.000	14.535	51.641	0.212	9.996	0.340	21.625	0.112	0.080	99.112	2.701	19.195	99.383
JR-MA-098-004	0.173	0.347	0.000	14.472	52.562	0.145	12.652	0.289	18.392	0.148	0.061	99.241	3.664	15.095	99.608
JR-MA-101-005	0.099	0.345	0.002	11.780	52.078	0.193	6.848	0.570	27.273	0.098	0.094	99.380	4.386	23.327	99.819
JR-MA-101-006	0.069	0.836	0.000	13.496	49.970	0.272	8.272	0.468	25.637	0.091	0.168	99.279	4.102	21.946	99.690
JR-MA-101-007	0.069	1.040	0.011	11.619	49.263	0.229	5.334	0.571	30.804	0.127	0.162	99.229	5.179	26.144	99.748
JR-MA-101-008	0.075	0.346	0.022	11.813	51.957	0.210	6.413	0.598	27.549	0.088	0.117	99.188	4.048	23.906	99.594
JR-MA-101-009	0.147	0.363	0.007	12.506	52.319	0.147	9.122	0.297	24.152	0.089	0.105	99.254	4.386	20.205	99.693
JR-MA-101-010	0.095	0.493	0.023	12.403	51.952	0.215	10.080	0.361	23.542	0.106	0.095	99.365	5.192	18.870	99.885
JR-MA-101-011	0.082	0.787	0.000	13.658	49.931	0.326	10.924	0.301	22.782	0.106	0.067	98.964	5.168	18.131	99.482
JR-MA-101-012	0.063	0.323	0.037	18.318	47.171	0.146	12.188	0.267	20.848	0.095	0.031	99.487	4.849	16.485	99.973
JR-MA-101-013	0.170	0.274	0.072	13.243	50.074	0.122	4.551	1.458	29.661	0.146	0.100	99.871	3.781	26.259	100.250
JR-MA-101-014	0.077	0.500	0.000	11.701	50.825	0.206	5.576	0.736	29.582	0.087	0.130	99.420	4.846	25.222	99.906
JR-MA-101-015	0.208	1.061	0.000	29.425	33.493	0.162	15.519	0.190	19.111	0.218	0.042	99.429	5.766	13.923	100.007
JR-MA-101-016	0.183	0.168	0.000	10.385	50.386	0.087	0.575	1.792	33.608	0.009	2.360	99.553	4.761	29.324	100.030
JR-MA-101-017	0.084	1.024	0.020	13.809	48.149	0.251	6.523	0.439	28.726	0.128	0.305	99.458	4.388	24.778	99.898
JR-MA-102-001	0.096	0.428	0.000	13.143	52.768	0.172	9.554	0.375	22.411	0.085	0.157	99.189	3.229	19.506	99.512
JR-MA-102-002	0.098	0.346	0.000	11.185	51.809	0.229	5.360	0.666	29.331	0.092	0.219	99.335	4.430	25.345	99.779
JR-MA-102-003	0.177	0.343	0.000	13.048	53.964	0.130	12.080	0.267	19.428	0.140	0.038	99.615	3.921	15.900	100.008

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-102-004	0.088	0.611	0.034	13.291	51.048	0.254	7.042	0.411	26.684	0.097	0.137	99.697	3.180	23.822	100.016
JR-MA-102-005	0.110	0.326	0.034	13.111	52.790	0.181	10.813	0.336	21.492	0.134	0.120	99.447	4.246	17.672	99.872
JR-MA-103-001	0.094	1.011	0.000	12.867	48.854	0.333	8.073	0.446	27.213	0.127	0.121	99.139	5.302	22.442	99.670
JR-MA-103-002	0.067	0.958	0.000	12.484	49.571	0.201	6.908	0.462	28.217	0.123	0.113	99.104	4.850	23.853	99.590
JR-MA-103-003	0.070	0.822	0.000	12.123	52.408	0.275	10.958	0.287	22.183	0.124	0.074	99.324	4.790	17.873	99.804
JR-MA-103-004	0.194	0.424	0.059	11.494	53.186	0.217	9.472	0.364	23.502	0.087	0.094	99.093	4.252	19.676	99.519
JR-MA-103-005	0.059	0.341	0.000	13.200	52.075	0.279	7.770	0.341	24.970	0.040	0.163	99.238	2.891	22.369	99.528
JR-MA-103-006	0.244	0.582	0.016	11.975	51.977	0.464	8.801	0.313	24.515	0.096	0.118	99.101	3.528	21.340	99.454
JR-MA-103-007	0.134	0.335	0.000	12.514	54.092	0.137	11.078	0.304	20.509	0.100	0.062	99.265	3.720	17.162	99.638
JR-MA-103-008	0.082	0.666	0.057	13.240	51.181	0.180	9.020	0.397	24.197	0.129	0.058	99.227	3.920	20.670	99.620
JR-MA-103-009	0.132	0.348	0.029	12.329	53.860	0.171	10.794	0.304	20.978	0.103	0.063	99.111	3.749	17.604	99.487
JR-MA-103-010	0.138	0.448	0.048	12.909	51.442	0.275	9.685	0.344	23.785	0.103	0.063	99.240	4.555	19.686	99.696
JR-MA-103-011	0.086	1.170	0.000	11.520	45.967	0.356	7.704	0.380	31.277	0.079	0.132	98.671	9.219	22.981	99.595
JR-MA-103-012	0.149	0.344	0.018	11.777	50.039	0.189	2.817	0.375	32.674	0.113	0.077	98.572	3.532	29.495	98.926
JR-MA-103-013	0.103	0.365	0.029	11.917	53.498	0.237	9.211	0.316	23.360	0.124	0.100	99.260	3.708	20.024	99.631
JR-MA-103-014	0.140	0.289	0.000	12.685	54.921	0.143	11.702	0.319	18.957	0.124	0.046	99.326	3.071	16.194	99.634
JR-MA-103-015	0.148	0.322	0.000	14.168	52.510	0.123	12.238	0.298	19.056	0.156	0.038	99.057	3.906	15.541	99.448
JR-MA-103-016	0.072	0.683	0.016	13.255	52.256	0.209	10.389	0.364	21.915	0.126	0.087	99.372	3.664	18.618	99.739
JR-MA-103-017	0.125	0.343	0.048	14.652	54.702	0.191	12.051	0.285	17.118	0.076	0.097	99.688	0.981	16.235	99.786
JR-MA-103-018	0.162	0.345	0.000	12.491	54.310	0.235	10.979	0.303	20.544	0.102	0.093	99.564	3.308	17.567	99.895
JR-MA-103-019	0.103	0.321	0.032	12.259	53.549	0.161	10.695	0.288	21.410	0.113	0.085	99.016	4.197	17.633	99.437
JR-MA-103-020	0.149	0.302	0.000	12.598	53.851	0.175	11.088	0.287	20.541	0.133	0.056	99.180	3.744	17.172	99.555
JR-MA-103-021	0.125	0.328	0.020	13.681	53.126	0.204	9.522	0.506	21.765	0.095	0.136	99.508	2.382	19.622	99.747
JR-MA-103-022	0.083	0.409	0.011	12.280	53.246	0.179	10.098	0.322	22.158	0.104	0.079	98.969	3.984	18.573	99.368
JR-MA-103-023	0.085	0.364	0.014	12.820	52.291	0.226	9.663	0.293	23.318	0.098	0.078	99.250	4.251	19.493	99.676
JR-MA-103-024	0.062	0.736	0.007	11.778	51.917	0.527	8.695	0.316	25.065	0.080	0.113	99.296	3.908	21.549	99.688
JR-MA-103-025	0.084	1.376	0.000	13.882	44.287	0.379	4.487	0.536	33.376	0.158	0.403	98.968	5.915	28.054	99.561
JR-MA-103-026	0.116	0.650	0.023	13.826	49.991	0.202	7.103	0.490	26.904	0.117	0.095	99.517	3.581	23.682	99.876
JR-MA-103-027	0.070	0.688	0.000	14.148	50.196	0.223	7.311	0.454	26.235	0.102	0.249	99.676	3.203	23.353	99.997
JR-MA-103-028	0.085	1.872	0.000	12.557	48.120	0.436	5.833	0.499	29.455	0.139	0.256	99.252	3.219	26.558	99.575
JR-MA-103-029	0.061	0.620	0.009	13.355	47.217	0.235	5.834	0.486	31.154	0.120	0.136	99.227	6.387	25.407	99.867
JR-MA-104-001	0.085	0.289	0.000	11.434	53.614	0.182	9.080	0.396	24.408	0.102	0.121	99.711	4.867	20.028	100.199
JR-MA-104-002	0.136	0.351	0.050	14.183	54.779	0.158	11.906	0.284	17.822	0.094	0.064	99.827	1.554	16.423	99.983
JR-MA-104-003	0.555	0.314	0.000	13.030	54.443	0.183	12.435	0.268	18.043	0.143	0.070	99.484	2.489	15.803	99.733
JR-MA-104-005	0.097	0.744	0.027	12.755	49.978	0.250	7.966	0.423	27.023	0.105	0.110	99.478	5.128	22.409	99.992
JR-MA-105-001	0.108	0.291	0.002	14.263	51.365	0.238	7.338	0.403	25.222	0.075	0.144	99.449	2.321	23.134	99.682
JR-MA-105-002	0.185	1.663	0.000	24.992	38.158	0.121	15.760	0.217	18.562	0.209	0.063	99.930	5.709	13.425	100.502
JR-MA-107-002	0.079	0.029	0.000	16.064	53.691	0.197	13.471	0.239	15.742	0.093	0.061	99.666	1.962	13.977	99.863
JR-MA-107-003	0.146	0.433	0.000	17.447	48.546	0.168	11.685	0.240	20.490	0.172	0.063	99.390	3.662	17.195	99.757

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NIO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-107-004	0.065	0.792	0.036	11.333	51.479	0.274	9.782	0.297	24.762	0.154	0.089	99.063	5.925	19.431	99.657
JR-MA-107-005	0.138	0.554	0.041	11.558	50.606	0.279	9.109	0.312	26.070	0.080	0.085	98.832	6.320	20.383	99.465
JR-MA-107-006	0.066	0.938	0.000	14.860	49.613	0.322	11.596	0.280	21.660	0.105	0.077	99.517	4.533	17.581	99.971
JR-MA-107-007	0.062	0.552	0.000	14.009	48.184	0.273	9.655	0.302	25.887	0.100	0.101	99.125	6.698	19.860	99.796
JR-MA-107-008	0.074	0.653	0.000	10.950	48.738	0.309	4.913	0.501	32.730	0.061	0.182	99.111	6.855	26.561	99.798
JR-MA-109-002	0.074	0.345	0.064	14.017	54.487	0.166	12.542	0.285	17.415	0.134	0.048	99.577	2.382	15.272	99.816
JR-MA-109-003	0.080	0.601	0.000	11.965	51.080	0.264	9.708	0.316	24.533	0.108	0.085	98.740	5.745	19.364	99.316
JR-MA-109-004	0.081	0.817	0.000	12.045	49.525	0.335	9.422	0.348	25.969	0.079	0.080	98.701	6.499	20.121	99.352
JR-MA-109-005	0.522	1.259	0.000	12.181	49.614	0.298	9.399	0.326	26.179	0.122	0.113	100.013	5.263	21.443	100.540
JR-MA-109-006	0.122	0.445	0.000	12.978	52.527	0.248	10.967	0.297	21.593	0.115	0.101	99.393	4.361	17.669	99.830
JR-MA-109-007	0.123	0.491	0.000	12.504	51.607	0.235	10.338	0.297	23.239	0.086	0.080	99.000	5.249	18.516	99.526
JR-MA-109-008	0.103	0.657	0.014	12.663	50.450	0.259	9.617	0.305	24.810	0.064	0.073	99.015	5.514	19.849	99.567
JR-MA-109-009	0.154	1.838	0.019	28.839	33.445	0.094	16.341	0.182	18.129	0.197	0.073	99.311	5.618	13.073	99.874
JR-MA-109-010	0.071	0.585	0.000	13.266	52.430	0.275	11.333	0.303	20.675	0.148	0.083	99.169	3.912	17.155	99.561
JR-MA-109-011	0.084	0.370	0.036	12.701	52.880	0.199	10.134	0.311	22.469	0.123	0.108	99.415	4.169	18.718	99.833
JR-MA-109-012	0.105	0.532	0.016	12.577	51.932	0.209	10.448	0.337	23.109	0.120	0.083	99.468	5.210	18.421	99.990
JR-MA-109-014	0.073	0.507	0.009	12.654	51.528	0.238	10.136	0.316	23.384	0.100	0.098	99.043	5.123	18.774	99.556
JR-MA-109-015	0.140	1.827	0.059	22.985	38.083	0.189	13.990	0.278	21.288	0.180	0.074	99.093	6.137	15.766	99.708
JR-MA-109-016	0.161	0.272	0.049	24.813	42.671	0.180	15.931	0.182	14.747	0.232	0.033	99.271	3.298	11.780	99.601
JR-MA-109-017	0.067	0.632	0.000	12.196	51.523	0.272	9.805	0.323	24.303	0.093	0.100	99.314	5.397	19.447	99.855
JR-MA-109-018	0.112	0.474	0.005	13.007	53.334	0.220	11.518	0.300	19.891	0.106	0.066	99.033	3.532	16.713	99.387
JR-MA-109-020	0.108	0.441	0.000	12.320	52.132	0.235	9.569	0.337	23.730	0.101	0.132	99.105	4.677	19.521	99.574
JR-MA-109-021	0.121	0.410	0.000	13.631	52.721	0.219	11.553	0.282	20.317	0.114	0.082	99.450	3.863	16.841	99.837
JR-MA-109-022	0.070	0.835	0.018	12.107	51.992	0.276	10.490	0.289	23.333	0.109	0.075	99.594	5.125	18.722	100.107
JR-MA-109-023	0.111	1.035	0.000	11.356	50.680	0.337	9.823	0.321	25.712	0.112	0.117	99.604	6.473	19.887	100.253
JR-MA-109-024	0.112	0.816	0.007	33.695	32.109	0.170	17.324	0.184	14.702	0.243	0.090	99.452	3.652	11.416	99.818
JR-MA-109-025	0.181	0.492	0.050	12.757	51.868	0.330	9.623	0.358	23.964	0.106	0.132	99.861	4.343	20.056	100.296
JR-MA-109-026	0.112	0.477	0.000	13.062	52.181	0.224	10.803	0.322	22.315	0.114	0.068	99.678	4.777	18.017	100.157
JR-MA-109-027	0.080	1.063	0.000	12.491	51.026	0.275	10.227	0.306	23.898	0.135	0.112	99.613	5.095	19.313	100.123
JR-MA-109-028	0.107	0.409	0.011	13.434	53.033	0.234	11.710	0.303	20.332	0.109	0.087	99.769	4.071	16.669	100.177
JR-MA-109-029	0.112	0.566	0.000	12.691	51.377	0.256	10.054	0.329	23.468	0.082	0.104	99.039	4.940	19.023	99.534
JR-MA-109-030	0.079	0.299	0.000	11.379	56.354	0.320	11.538	0.306	19.193	0.089	0.128	99.685	2.960	16.529	99.982
JR-MA-109-031	0.114	1.024	0.011	12.493	49.990	0.338	10.299	0.326	24.501	0.123	0.090	99.309	5.838	19.248	99.894
JR-MA-110-001	0.090	0.427	0.000	13.290	52.748	0.212	11.291	0.287	21.244	0.119	0.068	99.776	4.418	17.269	100.219
JR-MA-110-003	0.075	0.824	0.045	14.216	45.575	0.288	5.468	0.523	31.344	0.128	0.514	99.000	5.995	25.950	99.601
JR-MA-111-001	0.100	0.513	0.025	15.361	52.102	0.205	11.602	0.314	19.351	0.090	0.070	99.733	2.418	17.175	99.975
JR-MA-111-002	0.126	0.380	0.009	12.079	52.422	0.235	9.517	0.304	24.331	0.067	0.093	99.563	5.040	19.796	100.068
JR-MA-111-003	0.083	1.154	0.000	11.199	47.177	0.320	3.710	1.372	33.250	0.113	0.596	98.974	6.324	27.559	99.608
JR-MA-112-003	0.072	0.594	0.070	11.657	52.297	0.275	9.290	0.343	24.683	0.105	0.127	99.513	4.987	20.195	100.013

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-112-004	0.122	0.388	0.048	13.204	53.352	0.147	10.705	0.268	20.744	0.090	0.097	99.165	3.152	17.908	99.481
JR-MA-112-006	0.128	0.354	0.009	12.750	52.638	0.212	10.978	0.290	22.050	0.138	0.067	99.614	4.955	17.592	100.110
JR-MA-112-008	0.106	0.515	0.000	16.283	48.105	0.332	12.544	0.242	20.416	0.150	0.034	98.727	5.096	15.831	99.238
JR-MA-112-009	0.094	0.381	0.000	14.227	51.097	0.192	11.183	0.302	21.514	0.136	0.060	99.186	4.677	17.305	99.655
JR-MA-113-001	0.080	0.778	0.000	13.670	50.844	0.238	11.326	0.268	22.080	0.139	0.072	99.495	5.051	17.535	100.001
JR-MA-114-001	0.059	1.080	0.000	12.633	48.197	0.234	6.094	0.464	29.775	0.077	0.192	98.805	5.137	25.152	99.320
JR-MA-114-002	0.140	0.357	0.000	12.002	52.931	0.139	9.340	0.323	24.093	0.078	0.111	99.514	4.741	19.827	99.989
JR-MA-115-002	0.088	0.761	0.059	12.779	51.538	0.252	10.646	0.319	22.497	0.119	0.077	99.155	4.582	18.374	99.614
JR-MA-115-003	0.079	0.862	0.000	11.534	51.065	0.192	9.599	0.360	24.728	0.111	0.105	98.635	5.825	19.486	99.219
JR-MA-116-002	0.089	0.433	0.002	13.015	49.657	0.314	6.994	0.421	28.127	0.067	0.092	99.211	4.931	23.690	99.705
JR-MA-116-003	0.080	0.832	0.000	11.831	50.651	0.317	9.793	0.266	25.025	0.100	0.083	98.978	5.981	19.643	99.577
JR-MA-122-001	0.174	0.411	0.054	12.881	47.980	0.246	5.683	0.523	30.659	0.067	0.261	98.939	5.866	25.381	99.527
JR-MA-126-001	0.067	0.723	0.000	14.240	47.583	0.324	8.951	0.339	26.478	0.060	0.108	98.873	5.959	21.116	99.470
JR-MA-128-003	0.177	0.299	0.000	14.396	54.426	0.123	12.679	0.248	17.394	0.173	0.061	99.976	2.436	15.202	100.220
JR-MA-128-006	0.082	0.742	0.000	15.254	48.452	0.304	11.826	0.312	22.295	0.162	0.083	99.512	5.847	17.034	100.098
JR-MA-128-007	0.063	0.513	0.000	15.170	47.240	0.253	9.749	0.345	25.674	0.056	0.121	99.184	6.494	19.831	99.835
JR-MA-128-008	0.072	0.809	0.066	14.641	50.172	0.244	9.196	0.378	23.715	0.121	0.104	99.518	3.137	20.892	99.832
JR-MA-128-009	0.116	0.415	0.005	12.700	51.430	0.231	9.118	0.372	24.882	0.106	0.086	99.461	5.004	20.379	99.962
JR-MA-128-012	0.061	0.977	0.000	15.153	48.737	0.262	11.153	0.311	22.474	0.147	0.094	99.369	4.850	18.110	99.855
JR-MA-128-013	0.062	1.097	0.000	13.885	47.641	0.237	6.384	0.478	29.779	0.109	0.173	99.845	5.051	25.234	100.351
JR-MA-128-016	0.065	0.910	0.027	13.635	49.095	0.294	10.276	0.325	24.553	0.116	0.088	99.384	5.863	19.278	99.971
JR-MA-128-017	0.084	0.779	0.029	12.302	50.257	0.209	9.963	0.348	25.449	0.107	0.110	99.637	6.740	19.384	100.312
JR-MA-128-018	0.170	0.322	0.000	12.585	53.982	0.169	11.276	0.303	20.482	0.103	0.077	99.469	3.862	17.007	99.856
JR-MA-128-019	0.096	0.616	0.030	15.119	47.975	0.255	10.291	0.320	24.228	0.121	0.112	99.163	5.687	19.111	99.733
JR-MA-128-020	0.095	0.890	0.041	13.071	47.377	0.283	5.121	0.610	31.701	0.160	0.339	99.688	5.634	26.631	100.253
JR-MA-130-005	0.106	0.488	0.000	14.664	47.562	0.211	8.623	0.368	27.225	0.135	0.103	99.485	6.412	21.455	100.127
JR-MA-130-006	0.063	1.145	0.002	12.598	47.987	0.334	9.844	0.318	26.743	0.130	0.097	99.261	7.498	19.996	100.012
JR-MA-130-007	0.123	0.296	0.000	11.363	52.471	0.133	7.955	0.386	26.321	0.076	0.085	99.209	5.211	21.632	99.731
JR-MA-130-008	0.161	0.331	0.000	11.967	53.756	0.183	9.462	0.306	23.471	0.082	0.105	99.824	4.064	19.814	100.231
JR-MA-130-009	0.134	0.369	0.000	12.994	52.606	0.236	10.834	0.309	21.202	0.137	0.063	98.884	3.964	17.635	99.281
JR-MA-130-010	0.230	1.301	0.000	13.177	50.054	0.316	10.568	0.370	23.547	0.144	0.105	99.812	4.650	19.363	100.278
JR-MA-130-011	0.073	0.134	0.041	18.030	46.235	0.219	10.780	0.291	22.463	0.128	0.108	98.502	4.836	18.112	98.987
JR-MA-130-012	0.072	1.418	0.000	12.996	49.510	0.379	10.194	0.357	24.485	0.095	0.136	99.642	5.107	19.890	100.154
JR-MA-130-013	0.169	0.309	0.000	12.131	52.869	0.193	10.398	0.287	22.562	0.108	0.100	99.126	4.847	18.200	99.612
JR-MA-130-014	0.111	1.298	0.038	14.563	47.907	0.310	7.164	0.438	27.550	0.136	0.188	99.703	3.424	24.470	100.046
JR-MA-130-015	0.138	0.524	0.009	12.192	50.505	0.271	7.935	0.362	27.271	0.050	0.109	99.366	5.497	22.325	99.917
JR-MA-130-016	0.075	2.091	0.000	11.541	44.206	0.379	6.892	0.451	33.389	0.117	0.122	99.263	9.137	25.168	100.178
JR-MA-130-017	0.066	0.813	0.005	13.480	49.035	0.189	6.698	0.468	27.813	0.100	0.208	98.875	4.204	24.030	99.296
JR-MA-130-018	0.086	0.589	0.000	11.912	51.557	0.270	9.730	0.338	24.545	0.082	0.103	99.212	5.646	19.464	99.778

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-130-019	0.117	0.378	0.000	14.249	51.297	0.168	9.233	0.426	23.139	0.102	0.072	99.181	3.314	20.157	99.513
JR-MA-130-020	0.137	0.309	0.000	12.300	52.868	0.132	8.409	0.362	24.535	0.094	0.113	99.259	3.832	21.087	99.643
JR-MA-130-021	0.106	0.393	0.000	11.988	51.995	0.256	9.639	0.310	24.235	0.108	0.096	99.126	5.351	19.420	99.662
JR-MA-130-022	0.089	2.205	0.054	11.129	45.242	0.392	8.711	0.336	30.560	0.142	0.110	98.970	8.939	22.516	99.866
JR-MA-130-023	0.053	0.658	0.000	9.865	52.225	0.261	5.661	0.498	29.654	0.134	0.138	99.147	5.059	25.102	99.654
JR-MA-130-024	0.112	0.372	0.029	12.874	50.758	0.187	7.782	0.353	26.487	0.088	0.118	99.160	4.688	22.268	99.630
JR-MA-130-025	0.196	1.063	0.052	25.943	38.269	0.104	15.659	0.197	17.201	0.217	0.077	98.978	4.773	12.906	99.456
JR-MA-130-026	0.075	0.752	0.000	15.036	50.476	0.258	11.988	0.295	20.090	0.131	0.086	99.187	3.892	16.588	99.577
JR-MA-130-027	0.084	1.096	0.057	14.872	46.838	0.284	10.691	0.282	24.764	0.120	0.095	99.183	6.383	19.020	99.823
JR-MA-130-028	0.098	0.424	0.036	14.719	50.899	0.245	11.410	0.267	20.738	0.133	0.061	99.030	3.963	17.172	99.427
JR-MA-130-029	0.093	0.589	0.023	14.017	49.429	0.202	7.610	0.384	26.812	0.113	0.091	99.363	4.316	22.928	99.795
JR-MA-133-001	0.054	2.137	0.000	10.347	48.558	0.389	8.298	0.406	28.828	0.155	0.093	99.265	6.643	22.851	99.931
JR-MA-133-002	0.089	0.636	0.000	11.940	49.783	0.217	5.797	0.469	29.645	0.123	0.102	98.801	5.006	25.140	99.303
JR-MA-133-003	0.133	0.749	0.000	11.157	53.766	0.267	10.627	0.273	21.744	0.114	0.068	98.898	4.037	18.112	99.302
JR-MA-133-004	0.084	0.672	0.000	15.981	48.279	0.288	10.855	0.351	22.481	0.042	0.072	99.105	4.442	18.484	99.550
JR-MA-133-005	0.073	1.075	0.011	13.263	48.290	0.224	5.849	0.470	29.671	0.093	0.201	99.220	4.384	25.726	99.659
JR-MA-134-001	0.066	0.626	0.027	13.307	47.178	0.264	9.144	0.355	27.663	0.101	0.117	98.848	7.984	20.479	99.648
JR-MA-135-001	0.109	0.666	0.018	12.523	51.517	0.257	10.172	0.295	23.374	0.114	0.115	99.160	4.914	18.953	99.652
JR-MA-135-002	0.104	0.427	0.000	14.855	49.914	0.228	8.019	0.420	25.104	0.104	0.118	99.293	3.197	22.227	99.613
JR-MA-140-001	0.071	0.742	0.014	13.220	50.231	0.251	7.091	0.421	27.331	0.108	0.118	99.598	3.940	23.786	99.993
JR-MA-140-002	0.045	0.530	0.000	13.119	50.297	0.166	6.872	0.450	27.657	0.105	0.187	99.428	4.509	23.600	99.880
JR-MA-140-004	0.141	0.341	0.000	13.603	55.393	0.199	12.907	0.266	16.721	0.119	0.084	99.774	2.156	14.781	99.990
JR-MA-140-005	0.123	0.341	0.038	9.534	56.197	0.259	9.133	0.367	23.639	0.119	0.059	99.809	4.057	19.988	100.216
JR-MA-140-006	0.140	0.422	0.012	29.757	36.291	0.239	16.301	0.170	16.190	0.158	0.050	99.730	4.226	12.388	100.153
JR-MA-140-007	0.123	0.609	0.023	13.906	50.304	0.319	11.377	0.315	22.333	0.106	0.113	99.528	5.361	17.509	100.065
JR-MA-140-008	0.053	2.148	0.000	10.289	45.899	0.395	8.320	0.367	31.440	0.129	0.128	99.168	9.519	22.875	100.122
JR-MA-140-009	0.091	0.462	0.000	15.549	47.384	0.378	11.093	0.271	24.012	0.142	0.082	99.464	6.531	18.136	100.118
JR-MA-140-010	0.140	0.224	0.029	12.058	56.803	0.204	13.235	0.277	16.820	0.139	0.077	100.006	3.100	14.030	100.317
JR-MA-140-013	0.121	0.216	0.044	18.721	46.821	0.164	11.353	0.299	21.586	0.162	0.101	99.588	4.316	17.702	100.020
JR-MA-140-014	0.141	0.334	0.000	12.432	49.238	0.205	2.457	0.237	34.127	0.082	0.283	99.536	4.101	30.437	99.947
JR-MA-140-015	0.067	1.910	0.000	12.757	44.839	0.466	9.455	0.313	28.988	0.128	0.111	99.034	8.377	21.450	99.873
JR-MA-140-017	0.104	1.062	0.014	14.823	44.520	0.310	5.446	0.460	32.358	0.070	0.351	99.518	6.204	26.775	100.140
JR-MA-140-018	0.083	1.095	0.000	14.348	48.508	0.251	7.481	0.437	26.936	0.155	0.213	99.507	3.812	23.506	99.889
JR-MA-140-019	0.205	0.983	0.000	29.776	34.926	0.115	16.466	0.174	16.689	0.248	0.050	99.632	4.756	12.409	100.109
JR-MA-140-020	0.374	0.589	0.025	14.742	49.067	0.292	11.440	0.305	22.207	0.141	0.098	99.280	4.989	17.717	99.780
JR-MA-140-021	0.053	1.260	0.041	14.617	47.173	0.302	7.607	0.409	28.015	0.133	0.194	99.804	4.727	23.761	100.278
JR-MA-140-022	0.078	0.504	0.000	13.186	47.408	0.235	6.034	0.467	31.024	0.066	0.309	99.311	6.774	24.929	99.990
JR-MA-140-023	0.072	0.941	0.000	13.832	49.510	0.280	7.075	0.481	27.652	0.089	0.246	100.178	3.898	24.144	100.569
JR-MA-140-024	0.082	0.979	0.014	13.824	49.337	0.252	7.749	0.437	26.720	0.118	0.126	99.638	4.041	23.084	100.043

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-140-025	0.094	0.911	0.011	14.125	48.394	0.249	8.641	0.350	26.720	0.124	0.096	99.715	5.391	21.869	100.255
JR-MA-141-001	0.073	0.453	0.000	14.802	52.636	0.150	11.951	0.322	19.229	0.119	0.069	99.804	3.195	16.354	100.124
JR-MA-141-002	0.095	0.730	0.041	12.872	48.816	0.342	6.276	0.450	29.104	0.088	0.379	99.193	4.782	24.801	99.672
JR-MA-141-003	0.235	0.289	0.034	11.842	53.734	0.132	8.422	0.358	24.132	0.116	0.074	99.368	3.279	21.182	99.696
JR-MA-141-008	0.084	1.634	0.009	14.299	46.189	0.412	9.798	0.335	26.665	0.146	0.102	99.673	6.290	21.005	100.303
JR-MA-141-010	0.137	0.547	0.000	13.181	50.278	0.265	7.140	0.484	27.348	0.110	0.100	99.590	4.192	23.576	100.010
JR-MA-141-012	0.077	0.980	0.000	12.189	48.762	0.299	9.304	0.341	27.100	0.110	0.100	99.262	7.267	20.561	99.990
JR-MA-141-013	0.156	0.290	0.023	12.514	54.022	0.103	9.000	0.376	23.584	0.132	0.061	100.261	3.414	20.512	100.603
JR-MA-141-014	0.091	1.275	0.000	13.287	46.038	0.290	4.695	0.356	33.286	0.110	0.328	99.756	5.906	27.972	100.348
JR-MA-141-015	0.095	0.577	0.000	13.574	53.684	0.181	11.000	0.326	20.154	0.095	0.090	99.776	2.631	17.786	100.040
JR-MA-141-016	0.064	0.684	0.009	11.258	51.082	0.237	8.499	0.375	26.916	0.098	0.090	99.312	6.284	21.262	99.942
JR-MA-141-017	0.079	0.735	0.039	14.192	51.595	0.193	11.255	0.303	21.172	0.157	0.070	99.790	3.883	17.678	100.179
JR-MA-141-018	0.083	1.132	0.000	10.872	50.951	0.290	8.324	0.467	26.684	0.119	0.108	99.030	5.497	21.737	99.581
JR-MA-141-019	0.084	0.567	0.052	12.828	51.509	0.264	9.315	0.341	23.518	0.116	0.081	98.675	3.860	20.044	99.062
JR-MA-141-020	0.079	1.019	0.000	12.558	47.262	0.286	4.973	0.488	31.439	0.078	0.286	98.468	5.276	26.691	98.997
JR-MA-141-021	0.108	0.134	0.041	18.657	38.411	0.328	4.248	0.475	36.121	0.114	0.092	98.729	8.576	28.404	99.588
JR-MA-141-022	0.100	0.325	0.018	11.624	51.239	0.161	5.569	0.560	28.521	0.067	0.416	98.600	4.246	24.701	99.025
JR-MA-141-023	0.074	1.348	0.009	11.615	43.474	0.395	3.883	0.553	37.006	0.090	0.360	98.807	9.221	28.709	99.731
JR-MA-141-024	0.066	1.189	0.016	13.445	46.651	0.207	5.221	0.480	31.561	0.079	0.366	99.281	5.428	26.677	99.825
JR-MA-141-025	0.067	0.532	0.052	13.164	51.782	0.239	8.397	0.452	24.538	0.123	0.139	99.485	3.387	21.490	99.824
JR-MA-141-028	0.092	1.248	0.007	13.327	49.070	0.264	9.588	0.658	24.347	0.176	0.106	98.883	4.867	19.968	99.371
JR-MA-141-029	0.103	0.388	0.000	12.769	52.175	0.178	9.673	0.325	23.608	0.127	0.087	99.433	4.651	19.423	99.899
JR-MA-141-030	0.078	1.125	0.000	14.850	48.231	0.247	7.097	0.435	27.770	0.104	0.132	100.069	3.644	24.491	100.434
JR-MA-141-031	0.089	0.688	0.000	10.931	51.254	0.321	7.932	0.323	27.494	0.116	0.137	99.285	5.869	22.213	99.873
JR-MA-141-032	0.109	0.754	0.000	13.526	46.954	0.305	8.105	0.473	28.608	0.077	0.093	99.004	7.039	22.274	99.709
JR-MA-141-033	0.131	0.366	0.063	12.786	50.721	0.277	7.666	0.355	26.687	0.089	0.150	99.291	4.508	22.631	99.743
JR-MA-141-034	0.086	0.912	0.000	14.623	48.147	0.171	6.836	0.453	27.857	0.082	0.179	99.346	3.966	24.288	99.743
JR-MA-141-035	0.072	0.857	0.002	15.651	50.917	0.274	12.382	0.274	18.947	0.151	0.090	99.617	2.921	16.319	99.910
JR-MA-141-036	0.145	0.333	0.000	12.559	51.533	0.181	6.508	0.462	27.261	0.110	0.133	99.225	3.627	23.998	99.588
JR-MA-141-037	0.053	0.622	0.054	14.861	47.627	0.242	7.575	0.440	27.554	0.121	0.119	99.268	4.978	23.075	99.767
JR-MA-141-038	0.090	0.863	0.025	13.367	46.179	0.296	8.526	0.356	29.078	0.064	0.093	98.937	8.072	21.815	99.746
JR-MA-142-001	0.124	0.425	0.052	11.786	51.956	0.250	8.766	0.372	25.448	0.090	0.107	99.376	5.122	20.839	99.889
JR-MA-142-002	0.117	0.366	0.038	12.879	51.329	0.188	9.422	0.341	24.069	0.091	0.095	98.935	4.822	19.730	99.418
JR-MA-142-003	0.137	1.094	0.016	12.142	50.744	0.319	9.404	0.361	25.063	0.087	0.108	99.475	4.902	20.652	99.966
JR-MA-142-005	0.109	1.071	0.000	14.848	45.647	0.282	6.321	0.524	30.098	0.120	0.240	99.260	5.345	25.289	99.795
JR-MA-142-006	0.221	0.311	0.002	15.867	44.703	0.269	5.942	0.562	30.934	0.142	0.555	99.508	6.350	25.220	100.144
JR-MA-142-007	0.132	0.337	0.000	12.716	50.541	0.165	5.696	0.518	28.667	0.063	0.220	99.055	3.978	25.088	99.454
JR-MA-142-008	0.206	1.276	0.045	30.567	32.268	0.165	15.986	0.203	17.935	0.230	0.070	98.951	5.028	13.411	99.455
JR-MA-142-009	0.066	0.505	0.000	12.463	51.592	0.178	8.018	0.473	25.884	0.115	0.109	99.403	4.543	21.797	99.858

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-142-010	0.159	0.327	0.009	10.750	54.082	0.218	8.810	0.337	24.112	0.088	0.088	98.980	4.141	20.386	99.395
JR-MA-142-011	0.190	0.336	0.034	12.088	52.703	0.206	9.188	0.326	23.571	0.098	0.115	98.855	3.962	20.006	99.252
JR-MA-142-012	0.379	0.932	0.000	15.314	47.973	0.381	11.818	0.280	21.907	0.141	0.084	99.209	4.710	17.669	99.681
JR-MA-142-013	0.103	0.361	0.005	11.900	51.572	0.283	7.980	0.351	25.950	0.120	0.156	98.781	4.689	21.730	99.251
JR-MA-142-014	0.075	1.699	0.032	11.519	49.140	0.339	9.580	0.356	26.241	0.112	0.114	99.207	6.153	20.705	99.823
JR-MA-142-015	0.122	0.482	0.020	12.590	52.293	0.237	9.830	0.334	23.700	0.084	0.076	99.768	4.640	19.525	100.233
JR-MA-142-016	0.083	0.900	0.007	18.591	37.874	0.377	3.096	0.483	37.559	0.089	0.118	99.177	7.319	30.974	99.910
JR-MA-142-017	0.175	0.852	0.036	33.252	31.999	0.144	17.310	0.190	14.859	0.274	0.055	99.146	3.876	11.371	99.534
JR-MA-143-001	0.090	0.367	0.088	12.923	53.506	0.177	10.887	0.304	21.090	0.123	0.073	99.628	3.744	17.722	100.003
JR-MA-143-002	0.111	0.986	0.000	15.134	48.022	0.277	7.996	0.405	26.545	0.121	0.135	99.732	3.905	23.031	100.123
JR-MA-143-003	0.077	0.142	0.009	16.580	54.237	0.112	14.531	0.281	13.106	0.081	0.024	99.180	0.961	12.241	99.276
JR-MA-143-004	0.102	0.556	0.036	13.071	51.607	0.188	6.970	0.515	26.285	0.098	0.116	99.544	2.955	23.626	99.840
JR-MA-143-005	0.063	0.883	0.031	11.587	47.854	0.282	4.780	0.548	32.977	0.046	0.411	99.462	6.739	26.913	100.137
JR-MA-143-006	0.153	0.318	0.000	13.243	53.098	0.128	10.801	0.297	20.727	0.123	0.068	98.956	3.506	17.573	99.307
JR-MA-143-007	0.138	0.349	0.014	14.168	50.249	0.213	9.416	0.338	23.605	0.106	0.085	98.681	4.145	19.875	99.096
JR-MA-143-008	0.087	1.014	0.064	15.443	47.066	0.197	7.216	0.504	27.592	0.129	0.211	99.523	4.034	23.962	99.927
JR-MA-143-009	0.096	0.334	0.002	12.047	53.433	0.178	10.341	0.293	21.901	0.102	0.072	98.799	4.235	18.091	99.223
JR-MA-143-010	0.103	1.278	0.000	13.571	47.027	0.369	10.118	0.295	26.136	0.153	0.102	99.152	6.924	19.906	99.846
JR-MA-144-002	0.086	0.395	0.018	14.039	54.580	0.151	10.135	0.332	19.728	0.076	0.100	99.640	0.909	18.910	99.731
JR-MA-144-003	0.091	0.414	0.000	12.348	52.154	0.245	10.018	0.319	23.814	0.079	0.098	99.580	5.304	19.041	100.111
JR-MA-144-007	0.084	0.757	0.029	13.728	44.567	0.294	2.710	0.997	35.399	0.054	0.439	99.058	6.303	29.727	99.690
JR-MA-144-008	0.066	0.712	0.000	14.365	45.771	0.342	9.020	0.332	28.373	0.082	0.097	99.160	8.006	21.169	99.962
JR-MA-144-009	0.064	1.315	0.011	14.855	46.009	0.269	6.971	0.429	29.273	0.127	0.184	99.507	5.124	24.662	100.020
JR-MA-144-010	0.063	0.632	0.000	13.604	51.469	0.184	9.258	0.436	23.907	0.055	0.068	99.676	3.889	20.408	100.066
JR-MA-144-011	0.065	1.304	0.045	11.350	47.508	0.344	7.140	0.463	30.125	0.104	0.130	98.578	7.069	23.764	99.286
JR-MA-144-012	0.139	0.346	0.002	12.790	54.154	0.149	12.157	0.273	19.059	0.154	0.060	99.283	3.868	15.579	99.670
JR-MA-144-015	0.170	1.143	0.024	29.424	33.513	0.171	16.119	0.201	18.682	0.230	0.063	99.740	6.170	13.130	100.358
JR-MA-144-016	0.077	1.433	0.049	12.457	47.757	0.343	5.852	0.425	30.245	0.129	0.283	99.050	4.685	26.029	99.519
JR-MA-144-017	0.084	0.392	0.000	12.535	52.704	0.255	9.780	0.313	23.060	0.119	0.071	99.313	4.169	19.309	99.731
JR-MA-144-018	0.081	0.501	0.000	14.183	50.413	0.213	7.604	0.439	26.034	0.123	0.092	99.683	3.498	22.887	100.033
JR-MA-144-019	0.091	0.335	0.007	12.787	51.770	0.203	7.469	0.522	25.851	0.068	0.515	99.618	3.952	22.295	100.014
JR-MA-144-020	0.073	0.821	0.016	13.044	45.526	0.300	4.790	0.591	33.526	0.112	0.387	99.186	7.326	26.934	99.920
JR-MA-144-021	0.050	1.132	0.014	14.394	46.846	0.326	6.115	0.491	29.380	0.142	0.271	99.161	4.283	25.526	99.590
JR-MA-144-022	0.109	0.365	0.034	12.545	51.082	0.218	7.784	0.332	26.655	0.086	0.125	99.335	4.805	22.331	99.816
JR-MA-145-001	0.050	0.691	0.000	16.362	47.259	0.306	11.325	0.346	22.389	0.164	0.088	98.980	5.245	17.670	99.505
JR-MA-145-002	0.138	1.223	0.036	28.989	33.860	0.143	15.734	0.206	18.253	0.222	0.049	98.853	5.429	13.368	99.397
JR-MA-145-004	0.191	1.146	0.000	29.384	33.563	0.142	15.962	0.174	18.312	0.240	0.066	99.180	5.733	13.154	99.754
JR-MA-145-005	0.073	0.407	0.059	12.763	50.206	0.213	6.881	0.593	27.775	0.042	0.295	99.307	4.895	23.371	99.797
JR-MA-145-006	0.070	0.594	0.000	12.731	50.647	0.316	8.256	0.381	26.102	0.111	0.150	99.358	4.756	21.823	99.835

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-145-007	0.066	2.004	0.000	16.708	42.907	0.117	10.149	0.566	25.433	0.172	0.111	98.233	6.086	19.957	98.843
JR-MA-145-008	0.079	1.062	0.000	15.243	46.498	0.235	7.246	0.424	27.715	0.144	0.130	98.776	4.328	23.821	99.210
JR-MA-148-001	0.156	0.340	0.007	12.470	52.680	0.204	8.343	0.473	24.145	0.135	0.110	99.063	3.311	21.166	99.395
JR-MA-148-002	0.053	1.052	0.005	17.613	37.271	0.318	2.423	0.461	38.972	0.064	0.206	98.438	8.197	31.597	99.259
JR-MA-148-003	0.081	0.388	0.005	14.533	55.334	0.147	12.743	0.292	15.782	0.080	0.058	99.443	0.897	14.975	99.533
JR-MA-148-004	0.067	0.900	0.014	13.690	48.344	0.249	6.418	0.442	28.508	0.127	0.173	98.932	4.205	24.724	99.353
JR-MA-148-005	0.055	1.119	0.000	17.826	36.854	0.364	2.714	0.447	39.415	0.087	0.206	99.087	8.770	31.524	99.966
JR-MA-148-006	0.053	0.412	0.032	17.743	37.156	0.358	3.210	0.397	39.048	0.094	0.203	98.706	9.969	30.078	99.705
JR-MA-148-007	0.082	0.557	0.059	12.363	53.005	0.244	10.881	0.290	21.720	0.113	0.082	99.396	4.323	17.830	99.829
JR-MA-148-008	0.037	1.150	0.000	17.655	36.594	0.329	2.534	0.443	39.468	0.091	0.229	98.530	8.829	31.524	99.415
JR-MA-148-009	0.057	1.181	0.000	13.023	45.388	0.321	7.316	0.483	30.333	0.079	0.081	98.262	7.578	23.514	99.021
JR-MA-148-010	0.104	0.437	0.043	12.040	51.154	0.237	8.349	0.383	25.327	0.092	0.093	98.259	4.689	21.108	98.729
JR-MA-148-011	0.130	1.535	0.012	26.481	35.289	0.144	15.890	0.210	19.394	0.191	0.062	99.338	6.909	13.177	100.030
JR-MA-148-012	0.053	2.143	0.000	12.290	46.417	0.348	9.921	0.365	26.300	0.180	0.110	98.127	6.724	20.250	98.801
JR-MA-148-013	0.141	0.865	0.002	31.309	34.660	0.171	17.047	0.168	14.711	0.219	0.062	99.355	3.486	11.574	99.704
JR-MA-148-014	0.049	2.040	0.014	17.832	36.645	0.333	3.312	0.418	37.955	0.093	0.218	98.909	7.365	31.328	99.647
JR-MA-148-015	0.081	0.638	0.007	18.018	37.400	0.346	2.600	0.478	39.050	0.094	0.201	98.913	8.704	31.218	99.785
JR-MA-148-016	0.150	0.390	0.013	11.336	52.026	0.248	7.212	0.406	26.846	0.100	0.239	98.966	4.495	22.802	99.416
JR-MA-148-017	0.059	1.548	0.025	16.904	36.363	0.332	2.663	0.467	40.578	0.109	0.197	99.245	9.694	31.855	100.216
JR-MA-148-018	0.068	1.011	0.000	18.496	35.968	0.342	2.770	0.474	39.215	0.102	0.263	98.709	8.890	31.216	99.600
JR-MA-148-019	0.072	1.167	0.000	17.783	37.463	0.370	2.916	0.473	38.395	0.063	0.222	98.924	7.996	31.200	99.725
JR-MA-148-020	0.059	0.817	0.000	14.438	47.101	0.311	9.291	0.562	26.375	0.093	0.112	99.159	6.506	20.521	99.811
JR-MA-148-021	0.513	0.158	0.050	19.083	36.531	0.320	3.220	0.465	38.242	0.059	0.215	98.856	8.514	30.581	99.709
JR-MA-148-022	0.068	0.906	0.000	16.936	36.783	0.337	2.606	0.474	40.985	0.134	0.207	99.436	10.650	31.402	100.503
JR-MA-148-024	0.062	0.954	0.000	15.874	47.523	0.318	12.319	0.298	22.102	0.172	0.088	99.710	6.080	16.631	100.319
JR-MA-148-025	0.081	1.361	0.000	13.379	45.906	0.263	4.942	0.499	32.522	0.089	0.291	99.333	5.691	27.401	99.903
JR-MA-148-026	0.073	0.719	0.000	15.938	44.984	0.271	6.310	0.405	30.587	0.113	0.249	99.649	5.822	25.348	100.232
JR-MA-148-027	0.072	1.150	0.020	14.806	47.987	0.292	6.980	0.448	27.666	0.132	0.242	99.795	3.480	24.535	100.144
JR-MA-148-028	0.023	0.467	0.000	17.724	37.179	0.354	3.271	0.402	39.376	0.096	0.218	99.110	10.342	30.070	100.146
JR-MA-148-029	0.071	1.069	0.037	18.795	36.679	0.304	2.653	0.461	39.050	0.097	0.196	99.412	8.094	31.767	100.223
JR-MA-148-030	0.068	1.143	0.021	16.845	36.813	0.350	3.054	0.406	40.010	0.395	0.197	99.302	10.313	30.730	100.335
JR-MA-148-031	0.127	0.326	0.007	12.748	52.777	0.216	10.096	0.302	22.749	0.134	0.076	99.558	4.306	18.874	99.989
JR-MA-148-032	0.068	2.042	0.029	10.715	49.021	0.362	9.136	0.376	27.317	0.121	0.125	99.312	6.366	21.589	99.950
JR-MA-148-033	0.049	0.223	0.000	20.066	35.603	0.323	2.888	0.455	39.276	0.075	0.235	99.193	9.470	30.755	100.142
JR-MA-148-034	0.087	0.620	0.009	12.746	49.221	0.316	7.768	0.369	28.510	0.058	0.117	99.821	6.241	22.894	100.446
JR-MA-148-035	0.117	0.330	0.025	13.190	53.030	0.225	11.015	0.281	21.069	0.129	0.087	99.498	3.912	17.549	99.890
JR-MA-149-005	0.073	0.562	0.045	11.870	51.308	0.294	7.011	0.515	27.725	0.117	0.155	99.675	4.660	23.532	100.142
JR-MA-149-006	0.194	0.926	0.031	27.536	37.501	0.118	15.981	0.169	17.602	0.207	0.078	100.343	5.092	13.020	100.853
JR-MA-149-008	0.059	1.171	0.029	14.253	48.804	0.237	6.808	0.467	27.645	0.153	0.273	99.899	3.385	24.599	100.238

Appendix E. Chromites

Sample	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO^*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
JR-MA-149-010	0.067	0.658	0.077	14.833	46.958	0.252	6.724	0.501	29.237	0.102	0.150	99.559	5.277	24.489	100.088
JR-MA-149-011	0.103	0.442	0.000	14.132	51.959	0.198	9.524	0.440	22.826	0.122	0.100	99.846	3.217	19.931	100.168
JR-MA-149-012	0.061	1.618	0.000	13.528	44.482	0.400	8.992	0.349	29.455	0.092	0.086	99.063	8.354	21.938	99.900
JR-MA-149-013	0.160	0.301	0.007	12.163	52.419	0.199	7.713	0.310	26.181	0.124	0.079	99.656	4.144	22.452	100.071
JR-MA-149-014	0.078	0.629	0.000	15.667	47.781	0.207	8.468	0.448	26.127	0.094	0.101	99.600	4.693	21.904	100.070
JR-MA-149-015	0.048	1.318	0.000	14.181	47.388	0.291	6.877	0.433	28.307	0.148	0.130	99.121	4.131	24.590	99.535
JR-MA-149-016	0.070	1.310	0.052	14.638	44.172	0.332	5.548	0.523	32.341	0.132	0.218	99.336	6.181	26.779	99.955
JR-MA-149-017	0.095	0.588	0.002	9.707	57.412	0.043	12.241	0.246	19.048	0.189	0.087	99.658	4.434	15.058	100.102
JR-MA-149-018	0.101	1.690	0.000	25.831	37.362	0.168	15.304	0.220	18.987	0.190	0.087	99.940	5.283	14.233	100.469
JR-MA-150-001	0.047	0.828	0.086	14.583	51.358	0.184	10.767	0.311	21.177	0.129	0.068	99.538	2.992	18.485	99.838
JR-MA-150-002	0.049	2.134	0.000	12.997	43.930	0.482	3.598	0.781	34.968	0.152	0.346	99.437	5.491	30.027	99.987
JR-MA-150-003	0.087	0.728	0.000	16.338	47.791	0.181	7.821	0.420	26.535	0.124	0.188	100.213	3.750	23.161	100.589
JR-MA-150-004	0.155	0.297	0.000	12.509	52.320	0.141	9.166	0.309	24.353	0.099	0.107	99.456	4.705	20.120	99.927
JR-MA-150-005	0.104	1.498	0.000	12.153	43.277	0.378	4.202	0.607	36.167	0.148	0.415	98.949	8.721	28.320	99.823
JR-MA-151-001	0.036	0.092	0.000	41.646	24.539	0.150	16.282	0.169	16.854	0.164	0.270	100.202	3.570	13.642	100.560
JR-MA-152-005	0.082	0.468	0.036	15.342	49.693	0.212	10.115	0.374	22.837	0.109	0.082	99.350	4.020	19.220	99.753
JR-MA-152-006	0.097	0.405	0.000	12.538	52.978	0.208	10.643	0.357	21.861	0.122	0.071	99.280	4.413	17.890	99.722
JR-MA-152-007	0.112	0.483	0.000	28.161	33.466	0.240	13.292	0.190	23.070	0.166	0.063	99.243	7.185	16.605	99.963
JR-MA-152-008	0.131	0.348	0.000	14.417	52.269	0.189	11.246	0.301	21.159	0.116	0.070	100.246	3.964	17.592	100.643
JR-MA-152-009	0.121	0.332	0.022	12.407	49.570	0.213	3.368	0.699	32.696	0.110	0.149	99.687	4.410	28.728	100.129
JR-MA-152-010	0.026	0.186	0.000	20.304	35.172	0.268	2.803	0.527	39.677	0.054	0.118	99.135	9.846	30.817	100.122
JR-MA-152-011	0.162	0.336	0.018	14.172	52.333	0.232	11.187	0.278	20.485	0.131	0.079	99.413	3.339	17.480	99.748
JR-MA-152-012	0.055	1.602	0.000	13.773	46.963	0.297	6.572	0.483	29.676	0.145	0.223	99.789	4.797	25.359	100.270
JR-MA-152-013	0.082	1.763	0.002	13.054	44.919	0.321	8.362	0.370	29.982	0.110	0.142	99.107	8.001	22.782	99.909
JR-MA-152-014	0.072	1.386	0.000	12.963	45.285	0.280	5.671	0.488	32.323	0.169	0.278	98.915	6.929	26.088	99.609
JR-MA-152-015	0.142	0.356	0.007	15.168	53.042	0.215	14.462	0.293	16.066	0.181	0.030	99.962	3.695	12.742	100.332
JR-MA-152-016	0.179	0.331	0.005	14.110	52.648	0.194	11.102	0.257	20.878	0.117	0.056	99.877	3.472	17.754	100.225
JR-MA-152-017	0.061	0.716	0.000	15.843	47.775	0.299	10.760	0.349	23.696	0.136	0.088	99.723	5.501	18.746	100.274
JR-MA-152-018	0.092	0.366	0.000	16.189	48.674	0.198	7.676	0.450	25.700	0.121	0.166	99.632	3.153	22.863	99.948
JR-MA-152-019	0.061	1.490	0.011	19.733	39.140	0.415	3.837	0.432	34.696	0.102	0.094	100.011	4.261	30.862	100.438
JR-MA-152-020	0.069	1.429	0.000	12.771	48.831	0.268	10.071	0.331	25.545	0.122	0.130	99.567	6.299	19.877	100.198
JR-MA-152-021	0.055	1.142	0.047	10.620	48.005	0.363	7.223	0.412	30.996	0.096	0.117	99.076	8.171	23.644	99.895
JR-MA-152-022	0.108	0.337	0.000	12.996	53.716	0.216	11.767	0.284	20.045	0.123	0.043	99.635	4.036	16.413	100.039
JR-MA-152-023	0.107	0.478	0.000	12.867	51.944	0.200	10.295	0.333	22.983	0.121	0.109	99.437	4.883	18.589	99.926
JR-MA-152-024	0.081	0.679	0.000	16.517	48.976	0.229	9.731	0.501	22.655	0.076	0.232	99.677	2.922	20.026	99.970
JR-MA-152-025	0.108	0.879	0.057	14.648	50.551	0.213	8.549	0.406	24.179	0.122	0.141	99.853	2.455	21.970	100.099
JR-MA-152-026	0.157	0.339	0.032	14.185	51.698	0.178	10.204	0.288	22.886	0.113	0.060	100.140	4.114	19.184	100.552
JR-MA-152-027	0.160	0.495	0.016	16.708	49.250	0.134	10.580	0.333	21.643	0.119	0.051	99.489	3.161	18.799	99.806
JR-MA-152-028	0.059	1.446	0.043	14.060	45.003	0.340	5.745	0.447	31.815	0.163	0.290	99.411	5.909	26.498	100.003

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-152-029	0.077	0.328	0.043	11.980	53.806	0.227	10.907	0.337	21.759	0.115	0.061	99.640	4.700	17.530	100.111
JR-MA-152-030	0.084	0.387	0.020	12.500	52.042	0.247	9.601	0.354	24.160	0.084	0.086	99.565	5.008	19.654	100.067
JR-MA-152-031	0.108	0.853	0.032	15.275	48.515	0.203	7.832	0.443	26.432	0.126	0.143	99.962	3.685	23.116	100.331
JR-MA-152-032	0.079	1.146	0.047	12.877	48.142	0.239	5.545	0.475	30.967	0.106	0.249	99.872	5.054	26.419	100.378
JR-MA-152-033	0.127	0.337	0.041	16.967	51.178	0.152	14.050	0.211	16.995	0.124	0.063	100.245	3.605	13.751	100.606
JR-MA-152-035	0.056	0.793	0.016	15.866	48.859	0.203	9.219	0.428	24.317	0.130	0.087	99.974	3.670	21.015	100.342
JR-MA-152-036	0.078	0.488	0.000	13.335	51.885	0.248	11.726	0.282	21.376	0.104	0.085	99.607	5.231	16.669	100.131
JR-MA-152-037	0.073	1.380	0.000	13.758	47.350	0.314	10.555	0.280	25.512	0.146	0.065	99.433	6.817	19.378	100.116
JR-MA-152-038	0.061	0.626	0.000	14.817	49.268	0.259	9.423	0.393	24.668	0.101	0.112	99.728	4.695	20.444	100.198
JR-MA-152-039	0.075	2.296	0.009	15.908	43.134	0.237	12.428	0.299	25.139	0.167	0.106	99.798	8.344	17.631	100.634
JR-MA-152-040	0.059	1.413	0.000	11.514	49.693	0.332	9.231	0.340	26.078	0.108	0.108	98.876	5.830	20.832	99.460
JR-MA-152-041	0.166	0.260	0.000	12.901	52.412	0.170	7.129	1.056	24.552	0.158	0.423	99.227	2.705	22.118	99.498
JR-MA-152-042	0.093	0.681	0.045	13.905	49.203	0.240	7.140	0.415	26.982	0.102	0.210	99.016	3.821	23.544	99.399
JR-MA-152-043	0.094	0.418	0.011	14.574	49.423	0.198	6.743	0.417	26.514	0.072	0.264	98.728	3.022	23.795	99.031
JR-MA-152-044	0.124	0.307	0.020	14.093	50.838	0.199	10.149	0.273	22.754	0.107	0.058	98.922	4.351	18.839	99.358
JR-MA-152-045	0.073	0.771	0.000	11.319	47.747	0.266	4.045	0.673	33.639	0.132	0.414	99.079	6.801	27.519	99.760
JR-MA-152-046	0.121	2.040	0.000	13.054	45.115	0.426	9.123	0.321	28.575	0.106	0.121	99.002	7.191	22.104	99.723
JR-MA-152-047	0.093	0.359	0.000	11.980	50.719	0.261	5.475	0.370	29.579	0.096	0.102	99.034	4.362	25.654	99.471
JR-MA-152-048	0.145	0.318	0.000	12.078	53.226	0.114	8.610	0.346	23.935	0.110	0.182	99.064	3.698	20.607	99.435
JR-MA-152-049	0.087	1.600	0.020	13.709	46.952	0.282	9.554	0.322	26.104	0.159	0.105	98.894	5.886	20.808	99.484
JR-MA-152-050	0.106	0.364	0.043	14.140	51.267	0.198	10.367	0.247	21.925	0.107	0.076	98.840	3.768	18.535	99.217
JR-MA-152-051	0.096	0.646	0.000	12.884	51.579	0.200	9.903	0.356	23.405	0.116	0.064	99.249	4.577	19.287	99.708
JR-MA-152-052	0.090	2.511	0.032	9.077	40.353	0.373	7.231	0.334	37.768	0.146	0.083	97.998	14.753	24.493	99.476
JR-MA-152-053	0.155	0.327	0.000	11.855	53.044	0.175	8.554	0.316	24.172	0.126	0.091	98.815	3.755	20.793	99.191
JR-MA-152-055	0.140	0.284	0.000	13.327	52.491	0.175	10.447	0.287	21.348	0.113	0.096	98.708	3.643	18.070	99.073
JR-MA-152-056	0.114	0.978	0.000	26.455	39.424	0.198	15.978	0.204	16.414	0.197	0.058	100.020	4.057	12.764	100.426
JR-MA-152-057	0.073	0.464	0.000	13.298	50.139	0.234	7.962	0.432	26.645	0.070	0.108	99.425	4.969	22.174	99.923
JR-MA-152-058	0.126	0.358	0.000	28.227	34.846	0.209	14.221	0.211	20.659	0.152	0.055	99.064	6.314	14.978	99.697
JR-MA-152-059	0.059	1.768	0.011	13.696	46.692	0.392	6.368	0.454	29.587	0.098	0.297	99.422	4.152	25.851	99.838
JR-MA-152-060	0.066	2.083	0.000	11.940	42.567	0.357	3.451	0.521	36.943	0.134	0.266	98.328	7.823	29.904	99.112
JR-MA-152-061	0.123	0.596	0.000	11.828	51.058	0.162	12.444	0.280	22.090	0.239	0.055	98.875	7.813	15.060	99.658
JR-MA-152-062	0.060	0.566	0.000	12.880	49.887	0.252	9.633	0.343	25.329	0.105	0.107	99.162	6.315	19.647	99.795
JR-MA-153-002	0.061	1.359	0.000	14.116	48.159	0.362	11.131	0.281	23.570	0.158	0.086	99.283	5.643	18.493	99.848
JR-MA-153-003	0.094	0.890	0.000	13.309	49.753	0.238	6.900	0.450	26.938	0.123	0.165	98.860	3.389	23.888	99.200
JR-MA-153-006	0.086	0.685	0.070	15.596	47.989	0.254	6.929	0.478	27.745	0.123	0.170	100.125	3.630	24.479	100.489
JR-MA-153-007	0.091	0.332	0.000	11.788	53.896	0.170	11.244	0.276	21.149	0.121	0.076	99.143	4.877	16.761	99.632
JR-MA-153-008	0.060	1.666	0.016	14.362	45.869	0.401	10.460	0.288	25.798	0.142	0.110	99.172	6.581	19.877	99.831
JR-MA-153-009	0.079	0.907	0.002	12.920	50.495	0.258	10.108	0.313	23.902	0.119	0.091	99.194	5.125	19.291	99.707
JR-MA-153-010	0.116	0.960	0.071	28.472	36.742	0.189	16.192	0.207	16.181	0.217	0.075	99.422	4.020	12.564	99.825

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-156-001	0.070	0.432	0.007	15.679	50.177	0.201	10.144	0.360	22.123	0.124	0.097	99.414	3.326	19.130	99.747
JR-MA-157-018	0.135	0.304	0.000	13.532	51.988	0.155	9.942	0.286	23.066	0.129	0.090	99.627	4.348	19.154	100.063
JR-MA-157-019	0.154	0.304	0.045	12.377	55.295	0.133	11.227	0.299	19.229	0.093	0.074	99.230	2.569	16.918	99.487
JR-MA-157-020	0.121	0.411	0.029	12.808	54.041	0.237	10.670	0.413	19.798	0.131	0.078	98.737	2.310	17.720	98.968
JR-MA-157-021	0.166	0.686	0.000	13.612	51.763	0.240	11.247	0.310	21.498	0.124	0.072	99.718	4.211	17.709	100.140
JR-MA-159-001	0.144	0.357	0.084	13.635	53.362	0.172	12.214	0.259	19.260	0.163	0.059	99.709	3.737	15.897	100.083
JR-MA-160-017	0.137	1.153	0.007	11.935	45.727	0.400	3.947	0.594	34.515	0.068	0.403	98.886	6.688	28.497	99.556
JR-MA-160-018	0.097	0.282	0.000	11.979	52.541	0.106	6.568	0.521	26.549	0.047	0.277	98.967	3.529	23.374	99.321
JR-MA-160-019	0.087	0.210	0.009	18.596	49.141	0.189	9.419	0.454	21.228	0.055	0.237	99.625	0.946	20.377	99.720
JR-MA-160-020	0.158	0.295	0.000	13.626	53.836	0.169	12.670	0.273	18.158	0.163	0.045	99.393	3.545	14.968	99.748
JR-MA-160-021	0.126	0.257	0.066	13.572	54.905	0.161	12.080	0.284	17.595	0.143	0.077	99.266	2.049	15.752	99.471
JR-MA-165-001	0.072	0.319	0.000	18.245	46.651	0.217	11.772	0.265	21.286	0.141	0.077	99.045	4.802	16.965	99.526
JR-MA-165-002	0.148	0.304	0.000	13.491	51.898	0.218	10.122	0.292	22.232	0.128	0.083	98.916	3.868	18.752	99.304
JR-MA-165-003	0.084	0.774	0.000	14.171	49.909	0.265	9.652	0.373	23.559	0.119	0.076	98.982	4.012	19.949	99.384
JR-MA-165-004	0.063	1.031	0.032	15.232	46.910	0.202	7.157	0.490	26.711	0.129	0.290	98.247	3.564	23.504	98.604
JR-MA-165-005	0.117	0.658	0.000	13.664	52.399	0.199	10.736	0.341	21.010	0.103	0.125	99.352	3.176	18.152	99.670
JR-MA-165-006	0.135	0.218	0.000	13.639	52.746	0.124	7.357	0.561	23.706	0.109	0.489	99.084	1.719	22.159	99.256
JR-MA-165-007	0.187	0.297	0.000	13.506	56.088	0.146	15.129	0.174	13.896	0.203	0.018	99.644	2.837	11.343	99.928
JR-MA-165-008	0.096	1.581	0.000	14.294	46.148	0.270	6.406	0.435	29.325	0.151	0.194	98.900	4.291	25.464	99.330
JR-MA-165-009	0.134	0.379	0.000	12.057	51.259	0.240	6.627	0.734	27.408	0.098	0.120	99.056	4.275	23.561	99.484
JR-MA-165-010	0.059	1.303	0.000	15.470	44.348	0.357	6.314	0.503	30.576	0.130	0.254	99.314	5.446	25.676	99.860
JR-MA-165-011	0.052	1.334	0.000	16.249	45.972	0.269	9.694	0.361	25.334	0.150	0.168	99.583	5.052	20.788	100.089
JR-MA-167-001	0.111	0.393	0.000	14.918	53.466	0.185	12.532	0.275	17.259	0.111	0.053	99.303	2.041	15.423	99.507
JR-MA-167-002	0.072	1.051	0.000	12.887	45.958	0.415	4.114	0.582	33.640	0.150	0.426	99.295	5.977	28.262	99.894
JR-MA-167-003	0.089	0.960	0.031	11.947	48.963	0.305	5.399	0.574	30.398	0.115	0.268	99.049	4.848	26.035	99.535
JR-MA-167-005	0.060	0.708	0.000	13.537	48.612	0.288	9.727	0.333	25.776	0.135	0.085	99.261	6.610	19.828	99.923
JR-MA-167-006	0.120	0.281	0.000	14.100	53.531	0.174	13.694	0.239	16.369	0.181	0.037	98.726	3.488	13.230	99.076
JR-MA-168-001	0.108	0.843	0.000	12.211	48.376	0.302	8.970	0.337	27.145	0.078	0.098	98.468	7.077	20.777	99.177
JR-MA-168-002	0.050	1.311	0.000	12.814	49.176	0.291	10.700	0.338	24.216	0.123	0.090	99.109	6.125	18.704	99.723
JR-MA-168-003	0.081	0.678	0.023	14.952	50.477	0.231	9.493	0.381	23.255	0.137	0.082	99.790	3.164	20.408	100.107
JR-MA-168-004	0.127	0.314	0.000	14.488	52.053	0.150	11.994	0.289	19.889	0.144	0.071	99.519	4.193	16.116	99.939
JR-MA-168-005	0.365	0.580	0.072	12.410	51.232	0.169	10.241	0.357	23.668	0.108	0.093	99.295	5.175	19.012	99.813
JR-MA-168-006	0.100	0.425	0.018	16.000	51.625	0.165	12.803	0.295	18.286	0.131	0.057	99.905	3.264	15.349	100.232
JR-MA-168-007	0.127	1.836	0.024	25.791	36.477	0.188	15.150	0.226	18.968	0.223	0.098	99.108	5.116	14.364	99.621
JR-MA-168-008	0.123	0.327	0.025	13.698	51.037	0.182	9.733	0.304	24.157	0.111	0.088	99.785	5.026	19.634	100.289
JR-MA-168-009	0.113	0.837	0.005	14.014	45.958	0.283	8.513	0.328	28.878	0.078	0.101	99.108	7.689	21.959	99.878
JR-MA-168-010	0.113	0.306	0.014	13.160	52.335	0.226	10.335	0.319	22.608	0.109	0.066	99.591	4.466	18.589	100.038
JR-MA-168-011	0.158	0.318	0.000	14.043	53.771	0.151	12.262	0.280	18.305	0.187	0.038	99.513	2.944	15.656	99.808
JR-MA-169-001	0.094	0.394	0.034	12.930	51.227	0.214	8.392	0.340	25.590	0.100	0.167	99.482	4.607	21.445	99.944

Appendix E. Chromites

Sample	SIO2	TIO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NIO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-173-001	0.061	1.329	0.000	13.525	44.942	0.352	5.048	0.453	32.544	0.135	0.327	98.716	6.026	27.122	99.320
JR-MA-173-002	0.145	0.320	0.043	14.255	54.405	0.110	14.195	0.239	16.037	0.179	0.039	99.967	3.491	12.895	100.317
JR-MA-173-003	0.051	1.421	0.011	17.996	38.637	0.405	3.160	0.498	36.519	0.064	0.379	99.141	6.140	30.994	99.756
JR-MA-173-004	0.150	0.300	0.000	13.036	52.698	0.138	9.924	0.295	22.341	0.140	0.072	99.094	3.814	18.909	99.476
JR-MA-173-005	0.098	0.438	0.011	13.342	52.349	0.250	10.850	0.323	21.266	0.119	0.090	99.136	3.884	17.771	99.525
JR-MA-173-006	0.080	0.724	0.000	12.939	49.630	0.299	8.846	0.369	25.960	0.095	0.090	99.032	5.461	21.046	99.579
JR-MA-173-007	0.169	1.253	0.000	19.578	46.184	0.110	14.266	0.250	17.899	0.160	0.062	99.931	3.848	14.437	100.317
JR-MA-173-008	0.082	0.848	0.027	12.455	50.181	0.364	10.238	0.304	24.745	0.084	0.106	99.434	6.073	19.281	100.042
JR-MA-173-010	0.084	0.827	0.014	13.133	50.779	0.277	10.396	0.314	23.026	0.125	0.128	99.103	4.716	18.782	99.576
JR-MA-173-011	0.242	0.391	0.000	11.565	51.555	0.256	8.609	0.308	26.151	0.095	0.128	99.300	5.557	21.151	99.857
JR-MA-173-012	0.101	0.562	0.011	12.686	51.490	0.249	10.701	0.349	22.460	0.109	0.098	98.816	5.064	17.903	99.323
JR-MA-173-013	0.124	0.368	0.000	14.662	51.822	0.147	11.800	0.295	20.080	0.129	0.062	99.489	3.996	16.485	99.889
JR-MA-173-014	0.057	0.710	0.027	13.313	50.973	0.258	8.357	0.434	24.681	0.103	0.148	99.061	3.401	21.621	99.402
JR-MA-174-001	0.095	0.645	0.000	13.016	51.367	0.281	8.635	0.362	24.721	0.128	0.116	99.366	3.767	21.331	99.743
JR-MA-174-002	0.091	0.462	0.000	14.853	52.897	0.139	12.639	0.254	17.681	0.121	0.065	99.202	2.765	15.193	99.479
JR-MA-174-003	0.122	0.358	0.000	12.555	47.756	0.165	0.678	0.520	35.560	0.087	0.825	98.626	3.923	32.030	99.019
JR-MA-174-004	0.123	0.389	0.000	12.761	52.107	0.251	9.195	0.325	24.048	0.103	0.091	99.393	4.173	20.293	99.811
JR-MA-174-005	0.084	0.485	0.025	13.947	49.712	0.214	7.757	0.435	26.727	0.112	0.087	99.585	4.547	22.636	100.041
JR-MA-174-006	0.160	0.352	0.029	12.404	52.375	0.226	8.907	0.316	24.241	0.087	0.087	99.184	4.002	20.640	99.585
JR-MA-174-007	0.053	1.081	0.000	15.342	47.602	0.290	8.341	0.464	25.955	0.151	0.094	99.373	3.951	22.400	99.769
JR-MA-174-008	0.050	0.584	0.000	16.485	46.664	0.227	8.572	0.452	25.665	0.117	0.092	98.908	4.534	21.585	99.362
JR-MA-174-009	0.066	0.418	0.000	14.549	52.764	0.210	10.591	0.323	20.050	0.088	0.086	99.145	2.021	18.231	99.347
JR-MA-174-010	0.080	0.698	0.000	14.695	49.410	0.197	7.922	0.422	25.641	0.106	0.090	99.261	3.456	22.531	99.607
JR-MA-174-011	0.051	0.360	0.000	15.422	48.548	0.243	11.035	0.290	22.813	0.133	0.065	98.960	5.705	17.680	99.532
JR-MA-174-012	0.062	1.089	0.025	13.032	49.625	0.284	6.772	0.484	27.081	0.139	0.390	98.983	3.362	24.056	99.320
JR-MA-174-013	0.101	0.339	0.007	12.162	54.275	0.244	11.469	0.276	19.990	0.120	0.067	99.050	3.792	16.578	99.430
JR-MA-174-014	0.064	0.866	0.000	16.184	47.168	0.261	8.968	0.350	24.939	0.152	0.120	99.072	3.997	21.343	99.472
JR-MA-174-015	0.053	0.924	0.045	11.633	52.643	0.296	8.631	0.367	24.339	0.101	0.108	99.140	3.342	21.331	99.475
JR-MA-174-016	0.153	1.063	0.028	23.052	42.527	0.142	15.108	0.216	17.122	0.201	0.049	99.661	4.022	13.503	100.064
JR-MA-174-017	0.082	1.125	0.000	14.139	48.739	0.302	11.364	0.314	22.076	0.167	0.074	98.382	5.049	17.533	98.888
JR-MA-174-018	0.065	0.860	0.011	12.413	50.360	0.262	8.473	0.518	25.631	0.112	0.082	98.787	4.769	21.340	99.265
JR-MA-174-019	0.143	0.383	0.045	13.206	52.357	0.225	11.364	0.256	21.284	0.108	0.063	99.434	4.565	17.176	99.891
JR-MA-174-020	0.399	0.459	0.000	12.231	50.922	0.282	7.735	0.380	26.109	0.069	0.182	98.768	3.895	22.604	99.158
JR-MA-174-021	0.081	0.815	0.000	14.331	49.922	0.208	8.794	0.388	24.678	0.139	0.073	99.429	3.712	21.338	99.801
JR-MA-174-022	2.479	0.316	0.016	11.015	50.490	0.184	5.953	0.497	28.985	0.034	0.276	100.245	1.267	27.845	100.372
JR-MA-174-023	0.105	0.314	0.000	12.523	53.652	0.182	10.786	0.336	21.120	0.113	0.069	99.200	3.962	17.555	99.597
JR-MA-174-024	0.051	0.447	0.027	12.066	51.889	0.204	10.389	0.303	22.897	0.110	0.094	98.477	5.435	18.006	99.022
JR-MA-174-025	0.064	0.825	0.000	23.302	35.213	0.341	3.443	0.485	35.367	0.098	0.171	99.309	4.884	30.972	99.798
JR-MA-174-026	0.103	1.277	0.000	11.792	49.983	0.287	7.752	0.397	27.658	0.069	0.128	99.446	5.025	23.137	99.949

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-174-027	0.090	0.867	0.000	13.494	46.772	0.364	9.469	0.375	26.925	0.078	0.075	98.509	7.351	20.311	99.246
JR-MA-174-028	0.062	0.486	0.005	14.250	47.383	0.236	6.066	0.607	29.870	0.077	0.217	99.259	5.510	24.912	99.811
JR-MA-174-029	0.121	0.371	0.000	15.696	52.441	0.136	12.276	0.317	17.697	0.120	0.045	99.220	2.125	15.785	99.433
JR-MA-174-030	0.048	0.726	0.016	10.716	45.437	0.268	3.161	0.816	36.685	0.083	0.191	98.147	9.019	28.570	99.051
JR-MA-174-031	0.067	1.402	0.000	14.162	45.963	0.290	6.492	0.508	30.669	0.146	0.139	99.838	5.799	25.451	100.419
JR-MA-174-032	0.206	0.604	0.000	27.101	35.950	0.134	11.817	0.466	22.688	0.148	0.116	99.230	4.757	18.408	99.707
JR-MA-174-033	0.053	0.487	0.000	16.755	48.811	0.205	9.637	0.382	23.012	0.084	0.128	99.554	3.199	20.134	99.874
JR-MA-174-034	0.088	0.427	0.025	15.422	49.147	0.172	8.407	0.404	24.919	0.100	0.161	99.272	3.666	21.620	99.639
JR-MA-174-035	0.072	1.627	0.000	11.755	50.030	0.316	10.460	0.327	24.992	0.159	0.133	99.871	6.172	19.439	100.489
JR-MA-174-036	0.088	0.806	0.023	13.119	49.401	0.231	6.468	0.393	29.527	0.111	0.127	100.294	4.988	25.039	100.794
JR-MA-174-037	0.068	0.596	0.048	15.956	50.261	0.205	11.103	0.347	21.620	0.119	0.071	100.394	3.735	18.260	100.768
JR-MA-174-038	0.073	0.850	0.018	16.347	46.089	0.212	7.302	0.455	28.482	0.125	0.307	100.260	4.977	24.004	100.759
JR-MA-174-039	0.069	1.199	0.061	10.892	49.326	0.242	4.618	0.550	32.744	0.163	0.253	100.117	5.790	27.534	100.697
JR-MA-174-040	0.076	1.166	0.014	11.190	51.383	0.294	9.836	0.340	25.172	0.122	0.094	99.687	5.893	19.869	100.277
JR-MA-174-041	0.054	0.785	0.000	12.342	51.748	0.278	10.247	0.344	23.394	0.051	0.095	99.338	4.941	18.948	99.833
JR-MA-174-042	0.106	0.224	0.000	18.247	47.853	0.225	12.338	0.248	20.509	0.151	0.103	100.004	4.613	16.358	100.466
JR-MA-174-043	0.080	0.586	0.000	15.342	48.841	0.269	7.976	0.404	26.856	0.111	0.131	100.596	4.308	22.980	101.028
JR-MA-174-044	0.075	0.794	0.000	15.824	48.934	0.198	7.984	0.446	25.699	0.095	0.179	100.228	3.106	22.905	100.539
JR-MA-174-045	0.145	0.331	0.000	12.742	53.119	0.224	8.945	0.376	23.991	0.111	0.064	100.048	3.576	20.773	100.406
JR-MA-174-047	0.067	0.739	0.043	14.578	44.974	0.282	5.554	0.464	32.686	0.089	0.202	99.678	6.991	26.396	100.378
JR-MA-174-048	0.062	0.460	0.055	14.514	51.433	0.164	9.966	0.328	22.902	0.097	0.078	100.059	3.767	19.513	100.436
JR-MA-174-049	0.075	0.852	0.000	12.787	51.611	0.250	11.348	0.355	22.762	0.172	0.082	100.294	5.759	17.580	100.871
JR-MA-174-050	0.073	0.834	0.009	15.560	50.405	0.338	11.540	0.321	20.910	0.121	0.072	100.183	3.381	17.868	100.522
JR-MA-174-051	0.072	1.040	0.000	15.320	46.919	0.234	5.720	0.497	29.942	0.130	0.148	100.022	3.876	26.455	100.410
JR-MA-174-052	0.074	1.391	0.009	13.504	47.212	0.275	6.137	0.509	30.408	0.086	0.181	99.786	5.049	25.865	100.292
JR-MA-174-053	0.232	0.803	0.000	33.525	30.740	0.113	16.822	0.169	17.632	0.261	0.063	100.360	5.643	12.554	100.925
JR-MA-174-054	0.135	0.457	0.048	13.686	52.489	0.215	8.675	0.436	23.911	0.103	0.090	100.245	2.745	21.441	100.520
JR-MA-174-055	0.173	0.359	0.000	11.057	56.186	0.139	11.392	0.282	20.444	0.156	0.061	100.249	4.032	16.816	100.653
JR-MA-174-056	0.091	0.366	0.052	14.551	51.457	0.176	8.492	0.457	24.684	0.095	0.086	100.507	3.267	21.744	100.834
JR-MA-174-058	0.070	0.693	0.000	15.810	48.370	0.222	7.948	0.410	25.979	0.113	0.155	99.770	3.535	22.798	100.124
JR-MA-174-059	0.086	1.227	0.025	13.928	47.682	0.334	8.403	0.445	27.738	0.128	0.139	100.135	5.684	22.623	100.705
JR-MA-174-060	0.091	0.632	0.000	14.605	52.237	0.198	10.974	0.361	21.111	0.136	0.116	100.461	3.246	18.191	100.786
JR-MA-174-061	0.115	0.462	0.000	14.674	49.640	0.239	7.159	0.452	27.023	0.086	0.261	100.111	3.690	23.703	100.481
JR-MA-175-001	0.131	0.311	0.000	12.872	55.857	0.098	12.720	0.254	17.659	0.141	0.074	100.117	3.088	14.880	100.426
JR-MA-175-002	0.074	0.512	0.039	13.866	50.271	0.170	7.782	0.410	26.718	0.082	0.090	100.014	4.434	22.728	100.458
JR-MA-175-003	0.083	0.829	0.000	14.083	48.788	0.250	6.956	0.423	28.226	0.129	0.146	99.913	4.399	24.268	100.354
JR-MA-175-004	0.153	0.340	0.000	12.596	53.847	0.214	10.803	0.314	21.687	0.133	0.066	100.153	4.108	17.990	100.565
JR-MA-175-005	0.154	0.323	0.000	13.185	53.851	0.131	11.739	0.309	20.689	0.134	0.073	100.588	4.488	16.651	101.038
JR-MA-175-006	0.128	0.363	0.030	14.005	54.491	0.146	11.453	0.324	19.517	0.100	0.081	100.638	2.502	17.266	100.889

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-175-007	0.156	0.272	0.052	13.605	55.285	0.126	13.411	0.238	16.731	0.146	0.065	100.087	2.993	14.037	100.387
JR-MA-175-008	0.126	0.322	0.000	14.109	53.505	0.174	12.834	0.247	18.475	0.133	0.051	99.976	3.833	15.026	100.360
JR-MA-175-009	0.100	0.553	0.031	11.852	50.124	0.243	5.487	0.596	29.967	0.087	0.235	99.275	4.913	25.546	99.767
JR-MA-175-010	0.068	1.027	0.023	14.382	46.956	0.299	10.841	0.326	25.040	0.090	0.077	99.129	7.137	18.618	99.844
JR-MA-175-011	0.066	0.491	0.000	18.066	47.217	0.265	12.421	0.263	21.201	0.170	0.065	100.225	5.186	16.535	100.745
JR-SG-001-003	0.065	0.053	0.000	27.310	40.320	0.184	14.124	0.263	17.524	0.124	0.189	100.156	3.097	14.737	100.466
JR-SG-001-018	0.076	0.956	0.000	12.672	50.639	0.352	10.444	0.322	23.403	0.088	0.127	99.079	5.036	18.871	99.584
JR-SG-001-024	0.065	1.126	0.051	2.681	53.840	0.233	6.097	0.543	33.993	0.068	0.171	98.868	11.385	23.749	100.009
JR-SG-001-033	0.089	0.639	0.030	14.395	48.993	0.259	11.203	0.295	23.654	0.077	0.066	99.700	6.381	17.913	100.339
JR-SG-001-035	0.107	2.751	0.000	24.048	36.261	0.251	15.461	0.255	20.338	0.220	0.081	99.773	6.257	14.708	100.400
JR-SG-001-036	0.090	1.022	0.045	12.135	49.910	0.245	6.293	0.480	29.265	0.099	0.238	99.822	4.677	25.057	100.291
JR-SG-001-037	0.070	0.889	0.055	14.946	47.115	0.243	6.967	0.404	29.176	0.120	0.119	100.104	5.094	24.592	100.614
JR-SG-001-038	0.063	1.999	0.023	12.318	48.475	0.340	10.449	0.331	25.399	0.124	0.103	99.624	6.106	19.904	100.236
JR-SG-002-002	0.134	0.442	0.009	11.378	51.576	0.266	7.864	0.318	26.959	0.126	0.149	99.221	5.396	22.103	99.762
JR-SG-002-015	0.079	0.904	0.002	13.556	45.419	0.306	5.321	0.510	32.809	0.087	0.213	99.206	6.960	26.547	99.903
JR-SG-002-016	0.091	0.590	0.011	14.967	48.473	0.246	7.226	0.422	27.456	0.090	0.213	99.785	4.146	23.725	100.200
JR-SG-002-017	0.072	0.607	0.000	13.412	48.044	0.289	7.702	0.433	28.335	0.115	0.122	99.131	6.293	22.673	99.761
JR-SG-002-018	0.069	0.789	0.009	12.608	51.326	0.178	11.167	0.298	22.748	0.144	0.058	99.394	5.854	17.481	99.980
JR-SG-002-019	0.068	0.654	0.016	13.888	48.753	0.249	7.012	0.456	28.125	0.142	0.184	99.547	4.810	23.797	100.029
JR-SG-002-020	0.108	0.434	0.000	14.035	50.506	0.242	8.804	0.428	24.895	0.105	0.122	99.679	4.264	21.058	100.106
JR-SG-002-021	0.062	0.818	0.000	14.386	49.461	0.179	6.975	0.432	26.722	0.119	0.127	99.281	3.100	23.932	99.592
JR-SG-002-022	0.080	0.414	0.000	13.680	45.706	0.214	4.418	0.517	33.725	0.133	0.233	99.120	7.174	27.270	99.839
JR-SG-002-023	0.128	0.645	0.020	13.192	51.264	0.202	7.774	0.423	25.501	0.116	0.131	99.396	3.275	22.554	99.724
JR-SG-002-025	0.120	0.741	0.000	12.695	49.009	0.268	6.365	0.492	29.115	0.085	0.371	99.261	5.107	24.520	99.773
JR-SG-002-027	0.069	0.924	0.064	14.492	45.638	0.366	6.299	0.433	30.966	0.117	0.216	99.584	6.067	25.507	100.192
JR-SG-002-028	0.082	0.314	0.045	12.440	53.248	0.206	10.870	0.306	21.991	0.102	0.085	99.689	4.811	17.662	100.171
JR-SG-002-029	0.094	0.635	0.009	16.355	45.932	0.287	7.466	0.449	28.151	0.129	0.224	99.731	5.051	23.606	100.237
JR-SG-002-030	0.064	1.244	0.023	14.274	46.415	0.388	10.017	0.354	26.104	0.163	0.084	99.130	6.697	20.078	99.801
JR-SG-002-031	0.163	0.329	0.000	12.994	54.371	0.168	12.082	0.299	19.231	0.105	0.046	99.788	3.633	15.962	100.152
JR-SG-002-032	0.082	1.102	0.063	13.139	48.389	0.248	6.068	0.454	29.741	0.097	0.326	99.709	4.654	25.554	100.175
JR-SG-002-033	0.086	0.192	0.000	17.336	45.217	0.185	7.816	0.442	28.051	0.087	0.153	99.565	5.922	22.722	100.158
JR-SG-002-034	0.084	0.591	0.000	16.240	47.076	0.304	11.514	0.319	23.084	0.151	0.093	99.456	6.188	17.516	100.076
JR-SG-002-035	0.085	0.916	0.077	15.711	46.419	0.296	7.306	0.462	28.137	0.130	0.234	99.773	4.540	24.052	100.228
JR-SG-002-036	0.110	0.901	0.000	15.389	45.606	0.253	6.469	0.487	30.137	0.123	0.153	99.628	5.502	25.186	100.179
JR-SG-002-039	0.091	0.602	0.064	14.087	49.916	0.204	8.284	0.396	26.653	0.108	0.121	100.526	4.831	22.306	101.010
JR-SG-002-040	0.100	1.177	0.000	15.398	48.769	0.240	8.056	0.376	26.326	0.130	0.128	100.700	3.244	23.407	101.025
JR-SG-002-041	0.066	0.933	0.007	13.150	49.775	0.295	5.613	0.538	29.121	0.080	0.217	99.795	3.318	26.136	100.127
JR-SG-002-042	0.078	0.425	0.000	14.617	49.216	0.374	7.185	0.440	27.826	0.095	0.235	100.491	4.316	23.942	100.923
JR-SG-003-001	0.091	0.327	0.009	14.666	54.774	0.215	13.867	0.260	16.093	0.119	0.049	100.470	2.654	13.705	100.736

Appendix E. Chromites

Sample	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO^*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
JR-SG-003-003	0.066	0.698	0.000	15.429	50.567	0.210	9.777	0.376	23.329	0.135	0.097	100.684	3.393	20.276	101.024
JR-SG-003-006	0.135	0.373	0.000	13.030	52.859	0.277	11.019	0.307	21.900	0.131	0.109	100.140	4.551	17.805	100.596
JR-SG-003-007	0.059	0.536	0.000	12.728	50.765	0.231	6.549	0.505	28.398	0.140	0.187	100.098	4.572	24.284	100.556
JR-SG-003-008	0.085	0.508	0.000	14.149	49.939	0.208	7.275	0.472	27.100	0.110	0.150	99.996	4.084	23.425	100.405
JR-SG-003-009	0.079	1.931	0.000	11.889	45.221	0.427	8.762	0.321	30.678	0.150	0.095	99.553	9.076	22.511	100.462
JR-SG-003-010	0.094	0.788	0.000	14.301	49.005	0.227	7.835	0.424	27.124	0.121	0.101	100.020	4.601	22.984	100.481
JR-SG-003-011	0.087	0.996	0.023	13.347	50.083	0.335	7.293	0.460	27.209	0.097	0.165	100.095	3.603	23.967	100.456
JR-SG-003-012	0.055	0.812	0.007	15.025	47.186	0.165	6.461	0.467	29.175	0.096	0.332	99.781	4.885	24.779	100.270
JR-SG-003-013	0.112	0.603	0.000	12.923	52.246	0.237	9.744	0.343	23.437	0.119	0.095	99.859	4.102	19.746	100.270
JR-SG-003-014	0.116	1.352	0.000	14.513	47.934	0.232	8.442	0.391	26.636	0.137	0.116	99.869	4.501	22.586	100.320
JR-SG-003-015	0.062	0.969	0.041	14.457	45.950	0.278	6.073	0.443	31.501	0.089	0.133	99.996	6.172	25.948	100.614
JR-SG-003-016	0.168	1.058	0.000	27.079	37.372	0.144	16.233	0.214	17.520	0.193	0.064	100.045	5.523	12.551	100.598
JR-SG-003-017	0.075	0.901	0.036	15.115	48.952	0.225	9.095	0.371	25.464	0.127	0.117	100.478	4.440	21.469	100.923
JR-SG-003-018	0.069	0.464	0.052	13.534	53.142	0.176	10.874	0.370	21.076	0.140	0.075	99.972	3.548	17.884	100.327
JR-SG-003-019	0.095	0.797	0.032	14.114	47.793	0.341	6.374	0.503	29.472	0.122	0.290	99.933	4.825	25.130	100.416
JR-SG-003-020	0.079	0.459	0.025	14.880	51.071	0.125	8.972	0.358	23.834	0.117	0.075	99.995	3.208	20.947	100.316
JR-SG-003-021	0.030	0.934	0.000	14.137	49.955	0.273	10.510	0.319	23.226	0.106	0.103	99.593	4.734	18.966	100.067
JR-SG-003-022	0.169	0.334	0.005	12.285	53.990	0.123	9.667	0.367	23.203	0.135	0.063	100.341	4.042	19.566	100.746
JR-SG-003-023	0.075	0.527	0.000	21.475	43.288	0.252	9.532	0.351	24.354	0.089	0.213	100.156	3.371	21.321	100.494
JR-SG-003-024	0.073	1.615	0.016	14.298	46.013	0.286	6.444	0.445	30.471	0.141	0.169	99.971	5.160	25.828	100.488
JR-SG-003-026	0.081	1.110	0.000	14.944	47.839	0.328	12.001	0.313	23.079	0.164	0.092	99.951	6.505	17.225	100.603
JR-SG-003-027	0.072	0.333	0.000	12.097	54.165	0.188	10.103	0.414	22.251	0.116	0.089	99.828	4.035	18.620	100.232
JR-SG-003-028	0.095	0.939	0.000	15.213	45.668	0.349	6.540	0.447	30.312	0.062	0.176	99.801	5.517	25.348	100.354
JR-SG-003-029	0.061	1.454	0.000	13.660	44.701	0.288	5.111	0.478	33.410	0.118	0.226	99.507	6.670	27.408	100.175
JR-SG-003-030	0.106	2.230	0.026	19.562	39.765	0.188	13.201	0.241	24.431	0.146	0.074	99.970	8.142	17.105	100.786
JR-SG-003-031	0.116	0.664	0.000	12.612	51.029	0.277	6.481	0.482	27.696	0.083	0.383	99.823	3.635	24.425	100.187
JR-SG-004-001	0.073	0.734	0.000	12.699	51.103	0.214	6.680	0.449	27.706	0.097	0.238	99.993	3.836	24.254	100.377
JR-SG-004-002	0.163	0.337	0.014	12.741	54.577	0.148	10.655	0.307	21.215	0.117	0.058	100.332	3.312	18.235	100.664
JR-SG-004-003	0.075	1.484	0.000	12.530	46.159	0.352	4.772	0.495	33.207	0.119	0.358	99.551	6.055	27.758	100.158
JR-SG-004-004	0.098	0.610	0.041	14.003	50.224	0.203	7.791	0.439	26.268	0.118	0.173	99.968	3.915	22.745	100.360
JR-SG-004-005	0.162	0.336	0.011	12.778	54.244	0.189	11.213	0.305	20.822	0.097	0.060	100.217	3.764	17.436	100.594
JR-SG-004-006	0.070	0.720	0.011	12.565	50.119	0.247	6.486	0.490	28.830	0.115	0.216	99.869	4.798	24.513	100.350
JR-SG-004-007	0.143	0.315	0.000	12.790	54.978	0.188	9.519	0.389	21.528	0.097	0.147	100.094	1.986	19.741	100.293
JR-SG-004-008	0.070	0.377	0.000	11.299	49.224	0.182	3.083	0.688	34.074	0.058	0.569	99.624	6.109	28.577	100.236
JR-SG-004-009	0.146	0.279	0.039	13.967	53.935	0.087	12.708	0.267	18.486	0.155	0.045	100.114	3.771	15.093	100.492
JR-SG-004-010	0.090	0.869	0.046	15.518	48.911	0.248	11.979	0.299	21.455	0.132	0.093	99.640	4.970	16.983	100.138
JR-SG-004-011	0.090	1.438	0.005	14.135	47.610	0.284	6.558	0.535	29.023	0.172	0.270	100.120	4.145	25.294	100.535
JR-SG-004-012	0.058	1.236	0.000	14.702	47.995	0.271	11.857	0.311	23.131	0.157	0.094	99.812	6.410	17.363	100.454
JR-SG-004-013	0.052	1.842	0.000	13.350	48.351	0.313	7.191	0.425	27.829	0.173	0.255	99.781	3.631	24.562	100.145

Appendix E. Chromites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-SG-004-014	0.062	1.159	0.000	14.220	47.773	0.188	6.766	0.430	28.916	0.136	0.212	99.862	4.721	24.668	100.335
JR-SG-004-015	0.229	0.391	0.011	12.558	53.404	0.261	9.247	0.439	23.429	0.115	0.074	100.158	3.291	20.467	100.488
JR-SG-004-016	0.175	0.369	0.014	15.025	51.343	0.133	11.876	0.261	20.535	0.146	0.083	99.960	4.329	16.640	100.394
JR-SG-005-004	0.158	0.305	0.050	12.375	55.166	0.168	11.972	0.324	19.682	0.122	0.068	100.390	3.883	16.188	100.779
JR-SG-005-005	0.274	0.338	0.000	12.945	54.423	0.184	12.067	0.285	19.468	0.103	0.072	100.159	3.560	16.265	100.516
JR-SG-005-006	0.087	1.047	0.000	15.055	48.520	0.208	7.411	0.457	26.425	0.109	0.144	99.463	3.050	23.681	99.769
JR-TM-001-001	0.079	0.746	0.000	12.617	51.621	0.298	7.808	0.420	25.539	0.123	0.172	99.423	3.336	22.537	99.757
JR-TM-001-002	0.145	0.304	0.000	12.037	54.017	0.182	10.369	0.309	22.391	0.123	0.086	99.963	4.419	18.415	100.406
JR-TM-001-003	0.160	0.281	0.007	13.559	53.589	0.169	11.439	0.313	20.419	0.160	0.065	100.161	3.762	17.034	100.538
JR-TM-001-004	0.089	1.087	0.000	14.318	48.225	0.233	7.577	0.431	27.795	0.120	0.124	99.999	4.640	23.620	100.464
JR-TM-001-005	0.086	0.599	0.000	12.141	52.585	0.232	7.658	0.455	25.819	0.086	0.117	99.778	3.539	22.634	100.133
JR-TM-001-007	0.118	0.748	0.002	12.818	50.368	0.193	6.035	0.400	28.914	0.073	0.222	99.891	3.952	25.358	100.287
JR-TM-001-008	0.071	1.678	0.029	13.721	48.833	0.219	6.410	0.451	28.497	0.099	0.203	100.211	3.002	25.796	100.512
JR-TM-001-009	0.081	0.832	0.000	14.703	49.305	0.267	7.139	0.427	26.865	0.096	0.205	99.920	3.110	24.066	100.232
JR-TM-001-010	0.137	0.412	0.073	13.740	53.081	0.255	12.715	0.272	19.554	0.108	0.057	100.404	4.414	15.582	100.846
JR-TM-001-011	0.108	0.354	0.000	12.951	50.470	0.186	5.047	0.220	30.310	0.144	0.085	99.875	3.963	26.744	100.272
JR-TM-001-012	0.059	0.568	0.000	11.814	50.551	0.216	8.149	0.498	27.364	0.105	0.122	99.446	6.386	21.618	100.086
JR-TM-001-013	0.152	0.324	0.000	13.942	54.119	0.163	12.707	0.305	18.088	0.155	0.024	99.979	3.266	15.149	100.306
JR-TM-001-014	0.097	0.276	0.000	21.308	51.032	0.134	15.617	0.226	11.111	0.057	0.143	100.001	0.000	11.111	100.001
JR-TM-002-009	0.145	1.469	0.038	27.646	36.273	0.151	16.442	0.218	17.844	0.179	0.063	100.468	5.545	12.854	101.024
JR-TM-002-010	0.055	1.452	0.000	15.100	46.630	0.221	6.273	0.524	29.722	0.113	0.296	100.386	4.272	25.878	100.814
JR-TM-002-011	0.067	1.620	0.000	12.117	45.225	0.362	3.652	0.569	35.682	0.126	0.444	99.864	6.882	29.489	100.554
JR-TM-002-013	0.080	0.793	0.000	14.892	46.947	0.248	6.817	0.496	29.413	0.105	0.266	100.057	5.491	24.473	100.607
JR-TM-002-014	0.091	0.591	0.000	17.695	47.174	0.213	8.248	0.397	25.216	0.077	0.193	99.895	2.907	22.601	100.186
JR-TM-002-015	0.098	0.334	0.000	11.821	53.893	0.198	10.875	0.294	21.994	0.109	0.073	99.689	4.930	17.558	100.183
JR-TM-002-016	0.090	0.683	0.005	13.597	51.110	0.268	7.105	0.420	26.808	0.108	0.166	100.360	3.120	24.001	100.673
JR-TM-002-017	0.131	1.810	0.000	22.135	38.307	0.175	14.249	0.222	22.814	0.200	0.075	100.118	8.098	15.527	100.929
JR-TM-002-018	0.085	0.625	0.000	11.560	52.439	0.338	10.219	0.308	24.679	0.123	0.111	100.487	6.093	19.197	101.097
JR-TM-002-019	0.059	1.033	0.053	15.203	46.221	0.329	9.228	0.404	27.413	0.120	0.176	100.239	6.644	21.435	100.905
JR-TM-002-020	0.066	1.966	0.016	11.539	47.270	0.317	8.487	0.303	29.547	0.153	0.134	99.798	7.534	22.768	100.553
JR-TM-002-022	0.070	1.151	0.000	14.701	46.937	0.351	10.141	0.297	25.824	0.121	0.114	99.707	6.416	20.051	100.350
JR-TM-002-023	0.075	0.694	0.000	14.300	50.092	0.203	7.073	0.436	27.211	0.062	0.213	100.359	3.528	24.037	100.712
JR-TM-002-026	0.088	0.978	0.000	15.581	48.014	0.250	7.811	0.424	26.899	0.137	0.198	100.380	3.866	23.420	100.767
JR-TM-002-027	0.150	1.395	0.000	29.033	36.399	0.169	17.263	0.185	15.505	0.237	0.060	100.396	4.249	11.682	100.822

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
KIMBERLITIC CHROME DIOPSIDES (ACCORDING TO TERNARY PLOT)											
JR-MA-003-015	54.473	0.158	1.762	1.989	15.564	21.187	0.062	2.240	2.010	0.006	99.451
JR-MA-003-016	54.762	0.000	1.462	1.145	16.667	23.004	0.069	1.378	1.041	0.003	99.531
JR-MA-003-031	53.738	0.034	0.797	0.438	15.355	24.091	0.143	4.037	0.510	0.002	99.145
JR-MA-006-017	54.216	0.207	4.394	0.679	17.393	15.285	0.139	4.570	2.622	0.013	99.518
JR-MA-006-040	53.986	0.210	2.468	1.951	15.926	21.140	0.073	1.310	1.779	0.005	98.848
JR-MA-006-045	53.881	0.029	1.065	0.530	15.370	23.804	0.165	3.922	0.715	0.000	99.481
JR-MA-012-001	54.909	0.155	0.406	2.706	15.732	21.558	0.076	2.313	1.782	0.004	99.641
JR-MA-015-026	54.625	0.178	0.341	1.915	16.727	20.667	0.127	3.463	1.393	0.000	99.436
JR-MA-017-035	54.760	0.173	1.503	2.742	15.845	20.927	0.083	1.660	1.947	0.009	99.649
JR-MA-018-093	54.593	0.235	2.388	2.019	17.285	18.234	0.089	2.417	1.944	0.024	99.228
JR-MA-018-094	54.073	0.040	1.188	0.444	15.314	23.712	0.115	3.842	0.771	0.000	99.499
JR-MA-018-114	54.400	0.025	0.828	0.114	15.891	23.999	0.117	3.649	0.627	0.001	99.651
JR-MA-018-115	54.402	0.199	3.633	0.731	18.247	15.091	0.125	4.463	2.173	0.017	99.081
JR-MA-024-004	54.495	0.148	1.396	2.489	15.995	21.390	0.074	1.632	1.827	0.000	99.446
JR-MA-024-005	54.389	0.256	0.353	2.053	16.069	21.133	0.094	3.258	1.555	0.002	99.162
JR-MA-025-041	54.082	0.213	2.530	2.293	15.399	20.278	0.089	2.075	2.352	0.008	99.319
JR-MA-028-004	54.561	0.290	3.264	0.943	17.928	15.657	0.128	4.350	2.101	0.021	99.243
JR-MA-029-019	53.482	0.063	0.630	0.375	15.362	23.966	0.201	4.971	0.447	0.004	99.501
JR-MA-032-012	54.122	0.255	2.652	2.032	15.625	20.607	0.084	1.729	2.082	0.000	99.188
JR-MA-039-006	54.907	0.107	1.890	1.262	16.531	22.556	0.061	2.026	1.242	0.001	100.583
JR-MA-041-002	53.543	0.051	0.954	0.312	15.653	22.310	0.248	6.134	0.528	0.000	99.733
JR-MA-053-007	54.719	0.037	0.917	1.605	16.212	21.249	0.094	2.691	1.771	0.000	99.295
JR-MA-053-008	54.518	0.028	1.602	1.180	16.840	22.736	0.060	1.413	1.060	0.000	99.437
JR-MA-056-009	54.051	0.023	0.794	0.374	15.696	24.102	0.192	3.786	0.464	0.000	99.482
JR-MA-065-033	55.035	0.087	1.379	1.079	19.470	19.253	0.118	2.984	0.926	0.065	100.396
JR-MA-073-028	55.580	0.117	4.715	0.411	13.897	18.770	0.079	4.261	2.835	0.004	100.669
JR-MA-075-001	54.498	0.273	3.183	2.664	15.187	18.885	0.074	2.307	2.647	0.000	99.718
JR-MA-077-031	53.513	0.037	0.669	0.380	15.737	24.347	0.175	4.053	0.509	0.006	99.426
JR-MA-082-005	53.925	0.052	0.895	0.443	15.545	22.577	0.260	5.400	0.667	0.001	99.765
JR-MA-083-023	53.769	0.020	0.636	0.333	15.354	24.269	0.203	4.631	0.486	0.000	99.701
JR-MA-088-013	54.945	0.122	0.547	3.057	15.803	20.782	0.097	2.260	2.031	0.000	99.644
JR-MA-092-001	54.211	0.153	0.319	2.533	15.926	21.793	0.069	2.395	1.776	0.006	99.181
JR-MA-095-003	54.446	0.263	1.385	3.035	15.778	21.250	0.066	1.482	1.990	0.003	99.698
JR-MA-100-001	54.565	0.147	3.433	0.804	17.842	15.552	0.128	4.421	2.291	0.020	99.203
JR-MA-112-010	54.781	0.119	2.041	0.466	15.130	20.923	0.206	4.628	1.615	0.000	99.909

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
JR-MA-116-001	53.976	0.077	0.831	0.643	15.284	23.586	0.153	4.206	0.779	0.001	99.536
JR-MA-116-005	54.549	0.169	1.349	0.833	15.961	23.543	0.065	3.014	0.770	0.000	100.253
JR-MA-130-034	54.738	0.017	0.709	0.274	15.454	24.353	0.155	3.640	0.579	0.002	99.921
JR-MA-147-002	54.588	0.015	0.559	0.673	15.350	23.974	0.166	4.337	0.650	0.000	100.312
JR-MA-160-006	54.817	0.100	0.407	1.701	15.908	22.486	0.087	2.663	1.388	0.003	99.560
JR-MA-174-066	54.020	0.032	1.256	0.610	16.016	22.308	0.141	3.955	0.851	0.000	99.189
JR-SG-001-042	54.704	0.240	2.719	0.880	17.901	16.843	0.116	4.045	1.751	0.014	99.213
JR-SG-001-048	55.460	0.201	3.158	0.738	18.877	15.277	0.125	4.447	1.920	0.009	100.212
JR-SG-002-008	54.413	0.232	1.997	1.785	16.380	19.813	0.096	2.640	1.855	0.008	99.219
JR-SG-002-043	54.408	0.058	0.681	0.370	16.105	24.256	0.161	3.726	0.539	0.000	100.304
JR-SG-002-045	53.500	0.048	0.720	0.400	15.450	23.785	0.226	4.867	0.513	0.000	99.509
JR-SG-003-037	53.986	0.036	0.676	0.477	15.768	24.690	0.178	3.943	0.492	0.001	100.247
JR-TM-001-015	53.783	0.023	0.707	0.183	15.010	24.228	0.172	4.966	0.550	0.000	99.622
HIGH CR DIOPSIDES (KIMBERLITIC)											
Cr_2O_3 > 1.5 wt%)											
JR-MA-003-015	54.473	0.158	1.762	1.989	15.564	21.187	0.062	2.240	2.010	0.006	99.451
JR-MA-006-040	53.986	0.210	2.468	1.951	15.926	21.140	0.073	1.310	1.779	0.005	98.848
JR-MA-012-001	54.909	0.155	0.406	2.706	15.732	21.558	0.076	2.313	1.782	0.004	99.641
JR-MA-015-026	54.625	0.178	0.341	1.915	16.727	20.667	0.127	3.463	1.393	0.000	99.436
JR-MA-017-035	54.760	0.173	1.503	2.742	15.845	20.927	0.083	1.660	1.947	0.009	99.649
JR-MA-018-093	54.593	0.235	2.388	2.019	17.285	18.234	0.089	2.417	1.944	0.024	99.228
JR-MA-024-004	54.495	0.148	1.396	2.489	15.995	21.390	0.074	1.632	1.827	0.000	99.446
JR-MA-024-005	54.389	0.256	0.353	2.053	16.069	21.133	0.094	3.258	1.555	0.002	99.162
JR-MA-025-041	54.082	0.213	2.530	2.293	15.399	20.278	0.089	2.075	2.352	0.008	99.319
JR-MA-032-012	54.122	0.255	2.652	2.032	15.625	20.607	0.084	1.729	2.082	0.000	99.188
JR-MA-053-007	54.719	0.037	0.917	1.605	16.212	21.249	0.094	2.691	1.771	0.000	99.295
JR-MA-075-001	54.498	0.273	3.183	2.664	15.187	18.885	0.074	2.307	2.647	0.000	99.718
JR-MA-088-013	54.945	0.122	0.547	3.057	15.803	20.782	0.097	2.260	2.031	0.000	99.644
JR-MA-092-001	54.211	0.153	0.319	2.533	15.926	21.793	0.069	2.395	1.776	0.006	99.181
JR-MA-095-003	54.446	0.263	1.385	3.035	15.778	21.250	0.066	1.482	1.990	0.003	99.698
JR-MA-160-006	54.817	0.100	0.407	1.701	15.908	22.486	0.087	2.663	1.388	0.003	99.560
JR-SG-002-008	54.413	0.232	1.997	1.785	16.380	19.813	0.096	2.640	1.855	0.008	99.219

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
CR DIOPSIDES (NON KIMBERLITIC)											
(0.5 < Cr_2O_3 < 1.5 wt%)											
JR-MA-001-003	53.307	0.297	1.313	1.026	16.648	24.138	0.062	2.879	0.352	0.011	100.033
JR-MA-001-004	53.204	0.348	0.867	1.069	17.693	19.986	0.146	5.159	0.410	0.000	98.882
JR-MA-001-005	53.652	0.324	0.786	0.960	17.851	19.771	0.140	5.351	0.465	0.000	99.300
JR-MA-002-001	53.459	0.172	1.420	1.119	16.346	23.649	0.062	2.736	0.718	0.004	99.685
JR-MA-002-002	53.128	0.354	1.107	1.161	17.599	20.156	0.136	4.895	0.467	0.007	99.010
JR-MA-003-017	53.350	0.360	0.764	0.906	17.971	19.354	0.148	5.480	0.462	0.000	98.795
JR-MA-003-018	54.031	0.355	0.973	1.174	18.385	18.936	0.157	5.505	0.468	0.012	99.996
JR-MA-003-019	53.744	0.264	0.714	0.970	18.120	19.069	0.167	5.503	0.427	0.001	98.979
JR-MA-003-020	53.155	0.363	1.063	1.066	17.312	19.626	0.161	5.585	0.500	0.004	98.835
JR-MA-003-021	53.481	0.364	1.217	1.316	17.160	20.948	0.123	4.814	0.527	0.008	99.958
JR-MA-003-022	53.111	0.375	1.054	0.981	17.561	19.445	0.159	5.948	0.480	0.007	99.121
JR-MA-003-023	53.002	0.391	0.978	1.114	17.483	19.680	0.152	5.399	0.493	0.000	98.692
JR-MA-003-024	53.044	0.359	0.889	0.875	17.633	19.536	0.159	5.601	0.465	0.002	98.563
JR-MA-003-025	53.425	0.402	0.925	1.183	17.871	18.971	0.167	5.736	0.467	0.000	99.147
JR-MA-003-026	53.640	0.361	0.793	0.896	17.852	19.560	0.146	5.490	0.461	0.000	99.199
JR-MA-003-027	53.676	0.354	1.027	1.131	18.713	17.940	0.183	6.016	0.508	0.000	99.548
JR-MA-003-028	53.201	0.174	0.945	0.903	17.738	20.631	0.145	4.905	0.265	0.001	98.908
JR-MA-003-029	53.565	0.091	1.681	1.059	19.113	19.708	0.124	3.927	0.313	0.005	99.586
JR-MA-003-030	53.447	0.414	1.103	1.225	17.788	19.523	0.159	5.424	0.470	0.004	99.557
JR-MA-003-032	53.791	0.311	0.898	1.172	18.759	18.575	0.164	5.452	0.518	0.003	99.643
JR-MA-003-033	53.000	0.122	2.368	1.091	17.505	21.472	0.114	3.885	0.365	0.005	99.927
JR-MA-003-034	54.004	0.287	0.722	0.982	18.429	19.125	0.145	5.206	0.452	0.006	99.358
JR-MA-004-004	53.444	0.390	0.941	1.046	17.454	19.987	0.162	5.452	0.485	0.000	99.361
JR-MA-004-005	53.211	0.129	1.776	0.704	16.555	23.415	0.079	3.159	0.579	0.005	99.612
JR-MA-004-006	52.788	0.332	1.069	1.102	17.786	18.909	0.163	5.918	0.526	0.003	98.596
JR-MA-004-007	53.353	0.424	1.048	0.996	18.004	18.805	0.173	6.153	0.448	0.000	99.404
JR-MA-005-003	53.443	0.408	1.058	1.261	17.904	19.430	0.152	5.451	0.501	0.004	99.612
JR-MA-005-004	53.501	0.347	0.724	0.908	18.112	19.397	0.160	5.425	0.435	0.003	99.012
JR-MA-005-005	53.568	0.337	0.981	1.173	18.096	18.804	0.148	5.697	0.523	0.000	99.327
JR-MA-005-006	53.895	0.263	0.700	0.945	18.781	18.282	0.166	5.666	0.446	0.003	99.147
JR-MA-005-007	53.383	0.410	0.984	0.813	17.773	19.919	0.160	5.921	0.452	0.000	99.815
JR-MA-005-008	52.903	0.336	0.858	1.029	17.678	19.811	0.151	5.244	0.484	0.001	98.495
JR-MA-005-009	53.468	0.381	0.960	1.303	18.186	19.179	0.150	5.257	0.531	0.006	99.421
JR-MA-005-010	52.959	0.338	0.769	0.895	17.934	19.137	0.168	5.584	0.478	0.003	98.265

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
JR-MA-006-041	53.031	0.357	1.082	1.176	18.227	18.051	0.180	6.284	0.507	0.000	98.895
JR-MA-006-042	53.771	0.284	0.936	1.070	18.100	18.876	0.167	5.665	0.498	0.000	99.367
JR-MA-006-043	53.254	0.212	0.983	0.909	17.910	20.520	0.153	4.995	0.256	0.001	99.193
JR-MA-006-044	53.171	0.387	1.006	1.159	17.981	19.553	0.153	5.399	0.500	0.004	99.313
JR-MA-006-046	53.325	0.273	0.914	1.146	18.699	18.359	0.165	5.623	0.483	0.001	98.988
JR-MA-006-047	53.608	0.297	0.840	1.040	18.347	18.731	0.172	5.752	0.471	0.000	99.258
JR-MA-006-048	53.163	0.337	1.076	0.916	17.616	19.176	0.162	5.844	0.506	0.005	98.801
JR-MA-008-001	53.673	0.286	0.716	0.763	18.414	18.884	0.163	5.737	0.408	0.001	99.045
JR-MA-008-002	53.684	0.330	0.673	0.863	18.702	19.260	0.166	5.454	0.413	0.001	99.546
JR-MA-008-003	53.564	0.415	0.811	0.863	17.737	19.670	0.162	5.511	0.467	0.000	99.200
JR-MA-008-004	53.060	0.280	0.870	0.976	17.878	19.234	0.147	5.359	0.452	0.000	98.256
JR-MA-010-002	53.556	0.278	0.901	0.988	18.113	18.570	0.179	5.875	0.474	0.002	98.936
JR-MA-010-003	53.582	0.306	0.939	0.993	17.614	20.032	0.167	5.413	0.472	0.000	99.518
JR-MA-012-002	53.188	0.399	1.059	1.101	17.582	19.750	0.154	5.559	0.500	0.000	99.292
JR-MA-012-003	54.138	0.257	0.691	1.024	19.006	18.229	0.164	5.507	0.448	0.003	99.467
JR-MA-012-004	53.669	0.312	0.760	0.909	17.780	19.592	0.172	5.580	0.443	0.000	99.217
JR-MA-012-006	52.840	0.330	0.963	1.093	17.872	19.298	0.150	5.542	0.489	0.004	98.581
JR-MA-014-002	53.466	0.295	0.804	1.138	18.086	19.534	0.144	5.189	0.481	0.001	99.138
JR-MA-014-003	53.589	0.329	0.780	1.002	18.088	19.742	0.163	5.257	0.469	0.000	99.419
JR-MA-014-004	53.512	0.356	0.829	1.024	17.801	19.578	0.160	5.446	0.483	0.003	99.192
JR-MA-014-005	53.892	0.371	0.934	1.148	17.470	19.703	0.148	5.297	0.486	0.002	99.451
JR-MA-015-006	52.982	0.251	1.186	0.991	17.640	20.927	0.135	4.814	0.254	0.000	99.180
JR-MA-015-023	52.797	0.393	1.257	1.084	17.167	20.527	0.137	5.046	0.452	0.002	98.862
JR-MA-015-024	53.498	0.298	0.740	1.007	18.336	18.831	0.172	5.717	0.454	0.005	99.058
JR-MA-015-025	53.879	0.318	0.862	1.013	18.266	18.782	0.168	5.723	0.477	0.005	99.493
JR-MA-016-001	53.660	0.356	0.982	1.075	18.021	19.392	0.157	5.510	0.445	0.000	99.598
JR-MA-017-029	53.371	0.366	0.809	0.990	17.496	19.937	0.141	5.377	0.448	0.000	98.935
JR-MA-017-030	53.549	0.374	0.943	1.137	18.338	18.922	0.164	5.493	0.489	0.004	99.413
JR-MA-017-031	53.347	0.471	1.069	0.983	17.112	19.951	0.160	5.816	0.480	0.005	99.394
JR-MA-017-032	53.063	0.381	1.067	1.200	17.584	19.366	0.148	5.498	0.537	0.005	98.849
JR-MA-017-033	53.593	0.304	0.837	1.033	17.546	20.051	0.134	5.231	0.454	0.000	99.183
JR-MA-017-034	53.203	0.300	0.791	0.872	17.748	19.407	0.157	5.474	0.437	0.000	98.389
JR-MA-018-095	53.958	0.058	0.272	1.009	15.762	22.267	0.105	3.991	1.420	0.000	98.842
JR-MA-018-096	53.591	0.373	0.771	0.922	17.714	20.148	0.139	5.389	0.397	0.000	99.444
JR-MA-018-097	53.304	0.326	1.100	1.301	17.837	19.208	0.148	5.582	0.496	0.000	99.302
JR-MA-018-098	53.546	0.254	0.814	1.079	18.689	18.165	0.180	5.522	0.476	0.000	98.725

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
JR-MA-018-099	52.968	0.322	0.902	1.015	17.925	19.371	0.148	5.540	0.489	0.000	98.680
JR-MA-018-100	53.836	0.229	0.625	0.905	17.972	19.339	0.210	5.865	0.377	0.005	99.363
JR-MA-018-101	53.641	0.303	1.053	1.220	18.009	18.888	0.138	5.361	0.533	0.004	99.150
JR-MA-018-102	53.207	0.290	0.849	1.214	18.010	19.762	0.135	5.012	0.469	0.000	98.948
JR-MA-018-103	54.037	0.254	0.750	1.002	18.680	18.397	0.166	5.814	0.484	0.004	99.588
JR-MA-018-104	53.062	0.298	1.228	1.282	17.446	19.912	0.137	5.281	0.543	0.000	99.189
JR-MA-018-105	53.425	0.323	0.791	1.046	17.769	19.487	0.154	5.262	0.445	0.000	98.702
JR-MA-018-107	53.785	0.254	1.091	0.862	17.685	21.121	0.137	4.620	0.237	0.000	99.792
JR-MA-018-108	53.314	0.347	0.820	0.860	18.005	18.751	0.166	5.815	0.468	0.001	98.547
JR-MA-018-109	53.299	0.249	0.823	1.111	18.233	19.446	0.145	5.076	0.403	0.000	98.785
JR-MA-018-110	53.433	0.185	0.937	0.864	17.815	21.071	0.145	4.765	0.250	0.004	99.469
JR-MA-018-111	53.108	0.343	0.928	1.108	17.488	19.881	0.139	5.365	0.478	0.000	98.838
JR-MA-018-113	52.971	0.315	0.916	1.030	18.067	19.319	0.149	5.394	0.440	0.000	98.601
JR-MA-018-116	53.957	0.335	0.912	1.108	18.380	18.404	0.162	5.718	0.510	0.000	99.486
JR-MA-018-117	53.806	0.334	1.003	1.232	18.335	18.995	0.134	5.333	0.508	0.002	99.682
JR-MA-018-118	53.198	0.340	1.062	1.110	17.812	19.105	0.153	5.792	0.512	0.000	99.084
JR-MA-018-119	53.248	0.315	0.830	1.007	18.131	19.013	0.169	5.564	0.474	0.004	98.755
JR-MA-018-120	53.743	0.313	0.805	1.102	18.267	19.171	0.165	5.360	0.472	0.000	99.398
JR-MA-020-009	52.180	0.182	3.265	1.244	17.866	20.051	0.123	4.656	0.231	0.000	99.798
JR-MA-020-010	53.611	0.292	0.784	0.923	18.040	19.270	0.150	5.658	0.460	0.005	99.193
JR-MA-022-009	52.985	0.292	0.698	1.004	18.495	18.599	0.175	5.518	0.445	0.000	98.211
JR-MA-022-010	53.508	0.311	0.907	0.987	17.901	19.690	0.159	5.505	0.488	0.000	99.456
JR-MA-024-006	53.426	0.306	1.042	1.227	17.777	19.482	0.145	5.263	0.497	0.000	99.165
JR-MA-024-007	53.064	0.411	1.044	0.991	17.474	19.553	0.157	5.855	0.505	0.003	99.057
JR-MA-025-016	53.485	0.299	0.999	1.104	18.636	18.819	0.165	5.832	0.521	0.001	99.861
JR-MA-025-043	53.780	0.349	0.917	1.085	17.755	19.639	0.156	5.179	0.493	0.002	99.355
JR-MA-025-044	53.896	0.341	0.765	0.957	18.134	19.595	0.153	5.233	0.434	0.000	99.508
JR-MA-025-045	53.300	0.339	0.979	1.083	17.666	19.540	0.145	5.455	0.501	0.000	99.008
JR-MA-025-046	53.596	0.334	0.988	1.118	18.303	19.073	0.160	5.659	0.478	0.004	99.713
JR-MA-025-047	53.128	0.448	1.156	1.094	17.072	19.654	0.168	5.781	0.472	0.002	98.975
JR-MA-025-048	53.669	0.316	0.803	1.095	17.894	19.571	0.143	5.245	0.478	0.002	99.216
JR-MA-025-049	53.389	0.438	0.904	1.067	17.895	19.547	0.161	5.358	0.475	0.000	99.234
JR-MA-025-050	52.945	0.338	0.877	0.997	17.711	19.575	0.145	5.534	0.461	0.000	98.583
JR-MA-025-051	53.372	0.360	1.020	1.019	17.411	19.655	0.152	5.758	0.518	0.000	99.265
JR-MA-026-009	52.956	0.370	0.788	0.972	17.642	20.093	0.135	5.142	0.417	0.006	98.521
JR-MA-026-010	53.227	0.331	0.929	1.041	17.410	20.253	0.136	5.421	0.461	0.003	99.212

Appendix E. Cr-Diopsides

Sample	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	MnO	FeO	Na_2O	K_2O	TOTAL
JR-MA-026-011	53.984	0.268	0.653	0.928	19.049	18.688	0.155	5.293	0.423	0.000	99.441
JR-MA-026-012	53.566	0.415	0.948	0.761	17.611	19.393	0.178	6.144	0.459	0.000	99.475
JR-MA-026-013	53.561	0.303	0.910	0.905	18.221	18.635	0.157	6.022	0.488	0.000	99.202
JR-MA-026-014	54.313	0.343	0.827	0.978	18.553	18.696	0.162	5.499	0.463	0.000	99.834
JR-MA-026-015	53.665	0.310	0.759	0.804	18.222	19.026	0.164	5.879	0.439	0.004	99.272
JR-MA-026-016	53.637	0.339	0.864	1.164	18.184	19.229	0.151	5.260	0.487	0.000	99.315
JR-MA-026-017	53.769	0.381	0.947	1.169	18.054	19.112	0.152	5.579	0.481	0.004	99.648
JR-MA-026-018	52.858	0.398	0.972	1.145	17.947	19.479	0.142	5.490	0.509	0.000	98.940
JR-MA-027-008	53.173	0.311	0.884	0.967	17.536	20.791	0.139	5.162	0.467	0.004	99.434
JR-MA-028-003	53.635	0.327	0.752	1.008	17.849	19.436	0.144	5.378	0.445	0.000	98.974
JR-MA-028-005	53.257	0.373	0.923	1.115	18.075	19.465	0.148	5.435	0.467	0.004	99.262
JR-MA-029-005	53.948	0.267	0.843	1.111	18.791	19.076	0.145	5.237	0.494	0.000	99.912
JR-MA-029-006	53.313	0.315	0.899	0.974	17.912	20.312	0.145	5.121	0.401	0.000	99.392
JR-MA-029-014	53.517	0.340	1.004	1.283	17.714	19.287	0.158	5.407	0.504	0.000	99.214
JR-MA-029-015	52.989	0.348	1.111	1.169	17.536	20.308	0.141	5.102	0.459	0.000	99.163
JR-MA-029-016	52.766	0.205	2.422	0.989	17.555	21.640	0.083	2.903	0.182	0.004	98.749
JR-MA-029-017	52.840	0.305	0.885	1.092	18.218	19.264	0.148	5.494	0.475	0.002	98.723
JR-MA-029-018	53.737	0.286	0.801	1.004	18.316	18.660	0.165	5.654	0.482	0.000	99.105
JR-MA-029-020	53.807	0.299	0.745	0.997	18.192	19.372	0.164	5.434	0.477	0.005	99.492
JR-MA-029-021	52.834	0.371	0.997	1.176	17.799	19.541	0.153	5.374	0.495	0.004	98.744
JR-MA-029-022	52.650	0.333	1.041	1.112	17.542	19.538	0.152	5.327	0.485	0.002	98.182
JR-MA-030-017	53.461	0.343	0.942	1.055	17.686	19.510	0.156	5.497	0.487	0.002	99.139
JR-MA-030-018	53.340	0.264	0.894	0.924	18.217	19.460	0.151	5.370	0.451	0.000	99.071
JR-MA-037-009	53.420	0.275	0.698	0.951	18.386	19.806	0.148	5.324	0.429	0.000	99.437
JR-MA-037-010	53.642	0.340	1.035	1.207	17.912	19.569	0.160	5.551	0.508	0.000	99.924
JR-MA-037-014	53.006	0.204	1.060	0.893	17.762	20.963	0.135	4.701	0.239	0.000	98.963
JR-MA-038-002	53.226	0.323	0.875	1.082	18.462	18.863	0.166	5.469	0.467	0.000	98.933
JR-MA-039-007	53.561	0.325	1.029	1.186	18.527	18.299	0.169	5.837	0.505	0.003	99.441
JR-MA-039-008	53.433	0.327	0.910	0.887	18.702	18.801	0.159	5.389	0.368	0.001	98.977
JR-MA-039-009	54.072	0.352	0.886	0.883	17.824	19.434	0.153	5.679	0.474	0.002	99.759
JR-MA-039-010	53.399	0.361	0.793	0.877	17.951	19.673	0.152	5.332	0.443	0.005	98.986
JR-MA-039-011	52.718	0.290	0.756	0.764	17.602	18.885	0.294	6.784	0.446	0.006	98.545
JR-MA-039-012	53.417	0.252	0.811	0.833	17.726	20.266	0.145	4.880	0.377	0.000	98.707
JR-MA-039-013	53.382	0.310	0.736	0.975	18.488	18.880	0.153	5.502	0.450	0.002	98.878
JR-MA-039-014	53.741	0.318	0.882	1.046	17.929	19.650	0.160	5.207	0.490	0.004	99.427
JR-MA-039-015	53.745	0.321	0.879	1.148	17.676	19.475	0.143	5.217	0.446	0.005	99.055

Appendix E. Cr-Diopsides

Sample	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	MnO	FeO	Na_2O	K_2O	TOTAL
JR-MA-039-016	53.151	0.374	0.960	1.212	18.250	18.866	0.159	5.552	0.525	0.005	99.054
JR-MA-039-017	53.234	0.374	0.934	1.097	18.271	19.372	0.144	5.358	0.479	0.000	99.263
JR-MA-039-018	53.516	0.384	0.742	0.951	17.898	19.732	0.148	5.202	0.446	0.000	99.019
JR-MA-041-003	52.134	0.383	1.301	1.249	16.923	20.719	0.135	5.260	0.564	0.000	98.668
JR-MA-042-004	54.051	0.332	0.859	1.120	18.211	19.040	0.151	5.510	0.483	0.004	99.761
JR-MA-045-005	53.291	0.283	0.785	1.076	18.500	19.122	0.153	5.367	0.476	0.000	99.053
JR-MA-049-003	53.078	0.230	1.246	0.902	18.149	20.761	0.152	4.889	0.249	0.000	99.656
JR-MA-050-042	53.340	0.253	1.488	1.113	16.205	23.600	0.056	2.754	0.654	0.000	99.463
JR-MA-053-009	54.176	0.137	3.271	0.743	18.905	15.890	0.131	3.965	1.747	0.021	98.986
JR-MA-053-010	53.611	0.299	0.945	1.217	18.881	18.619	0.146	5.377	0.520	0.002	99.617
JR-MA-053-011	53.174	0.315	0.778	1.053	18.251	19.118	0.178	5.481	0.469	0.000	98.817
JR-MA-053-012	52.806	0.228	1.097	0.996	17.755	20.774	0.144	4.846	0.266	0.000	98.912
JR-MA-053-013	53.166	0.324	0.969	1.198	18.153	19.602	0.149	5.470	0.498	0.000	99.529
JR-MA-053-014	53.525	0.316	0.905	1.203	18.204	19.352	0.155	5.307	0.496	0.000	99.463
JR-MA-056-005	53.666	0.293	0.913	0.969	18.181	19.031	0.159	5.917	0.486	0.004	99.619
JR-MA-056-006	53.487	0.319	0.911	0.937	18.414	18.974	0.166	5.388	0.378	0.004	98.978
JR-MA-056-007	53.182	0.338	1.000	1.155	17.872	19.307	0.158	5.615	0.515	0.000	99.142
JR-MA-056-008	53.258	0.265	0.893	1.100	18.642	18.633	0.161	5.588	0.492	0.002	99.034
JR-MA-061-008	52.939	0.292	0.905	1.113	17.829	19.367	0.149	5.177	0.476	0.000	98.247
JR-MA-063-016	53.323	0.140	0.846	0.583	17.814	21.008	0.134	4.846	0.217	0.000	98.911
JR-MA-065-028	54.036	0.349	0.978	1.073	18.566	18.629	0.177	6.037	0.507	0.006	100.358
JR-MA-065-029	54.247	0.255	0.643	0.787	19.604	17.445	0.193	6.323	0.410	0.000	99.907
JR-MA-065-031	54.469	0.003	1.013	0.660	17.171	23.688	0.122	2.321	0.486	0.000	99.933
JR-MA-065-032	53.587	0.297	0.734	0.967	18.606	19.034	0.164	5.607	0.456	0.000	99.452
JR-MA-071-001	53.709	0.177	1.473	1.285	16.518	23.375	0.050	2.498	0.797	0.007	99.889
JR-MA-073-027	53.414	0.379	1.010	1.141	17.993	19.430	0.147	5.568	0.463	0.005	99.550
JR-MA-073-029	53.217	0.268	1.178	1.265	17.918	20.014	0.129	5.024	0.484	0.000	99.497
JR-MA-073-030	53.190	0.200	1.017	0.890	17.916	20.980	0.138	4.935	0.261	0.001	99.528
JR-MA-073-031	53.266	0.277	0.834	1.167	18.570	18.927	0.142	5.272	0.519	0.000	98.974
JR-MA-073-032	53.860	0.228	1.109	0.924	17.783	20.596	0.140	5.010	0.295	0.000	99.945
JR-MA-073-033	52.888	0.399	1.273	1.209	17.412	20.891	0.130	5.120	0.454	0.005	99.781
JR-MA-073-034	53.896	0.290	0.834	0.866	17.806	20.963	0.146	4.959	0.396	0.007	100.163
JR-MA-073-035	53.406	0.209	0.920	0.612	17.609	20.838	0.200	5.516	0.236	0.002	99.548
JR-MA-074-001	53.492	0.323	0.716	0.900	18.082	19.364	0.160	5.622	0.439	0.001	99.099
JR-MA-075-002	53.280	0.320	0.939	1.118	18.279	19.484	0.149	5.328	0.469	0.006	99.372
JR-MA-076-035	52.278	0.122	5.219	1.168	14.356	21.771	0.099	3.814	1.522	0.000	100.349

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
JR-MA-076-036	52.867	0.377	1.100	1.139	17.549	20.098	0.152	5.371	0.508	0.000	99.161
JR-MA-076-037	53.955	0.296	0.862	0.919	18.291	19.348	0.155	5.521	0.496	0.000	99.843
JR-MA-077-028	53.993	0.271	0.919	1.059	19.037	18.538	0.168	5.692	0.475	0.005	100.157
JR-MA-077-029	53.944	0.051	1.355	0.551	15.905	23.103	0.120	3.976	0.671	0.000	99.676
JR-MA-077-030	53.428	0.396	0.858	0.863	18.755	18.290	0.179	6.442	0.464	0.001	99.676
JR-MA-077-032	53.316	0.170	1.272	0.981	16.487	23.503	0.067	2.771	0.653	0.007	99.227
JR-MA-078-028	54.072	0.242	0.675	0.894	19.896	17.615	0.174	5.716	0.416	0.000	99.700
JR-MA-078-029	53.873	0.163	0.982	1.103	18.873	20.652	0.111	3.325	0.470	0.005	99.557
JR-MA-078-030	53.797	0.276	0.843	0.943	19.001	18.576	0.140	5.731	0.501	0.003	99.811
JR-MA-080-024	53.625	0.184	1.093	0.873	17.765	21.121	0.128	4.656	0.246	0.001	99.692
JR-MA-080-025	53.869	0.346	1.007	1.158	17.728	20.002	0.147	5.314	0.514	0.005	100.090
JR-MA-080-026	53.773	0.330	0.944	1.128	18.059	19.776	0.156	5.334	0.504	0.002	100.006
JR-MA-080-027	54.006	0.217	1.027	0.676	17.796	21.121	0.144	4.899	0.227	0.000	100.113
JR-MA-080-028	52.512	0.362	3.370	1.290	15.147	22.108	0.110	3.205	1.184	0.000	99.288
JR-MA-080-029	53.525	0.271	1.207	0.943	17.837	20.865	0.141	4.951	0.244	0.000	99.984
JR-MA-083-022	52.869	0.379	1.078	1.214	18.023	19.110	0.155	5.628	0.544	0.003	99.003
JR-MA-085-001	54.146	0.405	1.057	1.056	17.648	19.614	0.150	5.799	0.488	0.000	100.363
JR-MA-085-002	53.308	0.310	1.086	1.148	18.181	18.916	0.153	5.824	0.524	0.000	99.450
JR-MA-085-003	53.514	0.298	0.993	1.232	18.438	18.717	0.157	5.644	0.541	0.002	99.536
JR-MA-087-001	53.309	0.408	1.050	1.143	17.846	19.735	0.130	5.462	0.479	0.006	99.568
JR-MA-088-012	53.494	0.343	0.759	0.884	18.409	19.684	0.150	5.506	0.453	0.000	99.682
JR-MA-091-004	53.542	0.280	0.867	1.167	19.149	17.851	0.157	5.786	0.482	0.005	99.286
JR-MA-092-002	53.005	0.297	0.792	1.021	17.865	19.388	0.155	5.438	0.473	0.000	98.434
JR-MA-095-033	52.973	0.396	0.925	1.125	17.678	19.277	0.163	5.678	0.509	0.000	98.724
JR-MA-098-005	53.928	0.361	0.931	1.172	17.292	19.895	0.144	5.416	0.466	0.002	99.607
JR-MA-098-006	53.779	0.301	0.859	1.160	17.952	19.320	0.171	5.464	0.456	0.000	99.462
JR-MA-098-007	52.639	0.375	0.973	1.126	17.608	19.342	0.171	5.771	0.525	0.000	98.530
JR-MA-098-008	53.891	0.341	0.876	1.197	17.575	19.897	0.145	5.143	0.460	0.000	99.525
JR-MA-106-001	53.685	0.263	0.805	1.201	18.017	19.069	0.145	5.137	0.481	0.000	98.803
JR-MA-109-032	54.402	0.271	0.657	1.012	18.510	19.022	0.135	5.106	0.432	0.000	99.547
JR-MA-109-033	53.913	0.360	0.852	1.131	17.665	19.929	0.144	5.207	0.462	0.001	99.664
JR-MA-109-034	53.441	0.321	0.682	0.948	17.649	19.886	0.136	5.276	0.425	0.007	98.771
JR-MA-109-035	54.234	0.271	0.878	1.141	18.155	19.061	0.160	5.600	0.494	0.000	99.994
JR-MA-109-036	53.305	0.285	0.765	1.095	17.555	19.510	0.149	5.352	0.477	0.001	98.494
JR-MA-109-037	53.918	0.319	0.689	1.083	18.235	18.970	0.168	5.331	0.460	0.003	99.176
JR-MA-109-038	53.134	0.295	1.311	1.141	17.198	19.656	0.148	5.427	0.618	0.005	98.933

Appendix E. Cr-Diopsides

Sample	SiO_2	TiO_2	Al_2O_3	Cr_2O_3	MgO	CaO	MnO	FeO	Na_2O	K_2O	TOTAL
JR-MA-110-004	53.742	0.269	0.862	1.228	18.057	19.017	0.163	5.438	0.517	0.005	99.298
JR-MA-110-005	53.078	0.221	2.004	1.071	17.581	23.212	0.069	2.495	0.181	0.000	99.912
JR-MA-110-006	53.817	0.292	0.810	1.052	17.920	19.363	0.160	5.474	0.483	0.000	99.371
JR-MA-110-007	53.473	0.367	0.892	0.987	17.589	19.706	0.158	5.646	0.503	0.002	99.323
JR-MA-111-004	53.432	0.382	0.920	1.128	17.517	19.825	0.150	5.424	0.474	0.002	99.254
JR-MA-111-005	53.292	0.326	0.941	1.090	17.009	20.614	0.140	5.217	0.529	0.002	99.160
JR-MA-111-006	54.022	0.315	0.780	1.100	17.657	19.645	0.147	5.313	0.463	0.000	99.442
JR-MA-115-004	53.697	0.256	0.749	1.060	17.508	20.247	0.127	4.908	0.494	0.002	99.048
JR-MA-122-002	53.899	0.323	0.876	1.222	18.215	19.036	0.143	5.430	0.510	0.003	99.657
JR-MA-122-003	54.102	0.321	0.789	0.912	17.990	18.915	0.170	5.800	0.468	0.001	99.468
JR-MA-123-002	54.275	0.301	0.884	1.225	18.560	18.820	0.144	5.130	0.459	0.000	99.798
JR-MA-124-001	54.057	0.296	0.720	0.987	17.703	19.691	0.143	5.276	0.451	0.001	99.325
JR-MA-128-021	53.886	0.298	0.924	1.191	18.204	18.988	0.163	5.609	0.510	0.003	99.776
JR-MA-128-022	54.362	0.353	0.912	0.922	18.134	19.111	0.165	5.827	0.483	0.003	100.272
JR-MA-128-023	53.372	0.332	1.181	1.236	17.103	20.659	0.143	5.045	0.519	0.012	99.602
JR-MA-128-024	54.048	0.285	0.407	0.793	17.805	22.903	0.066	2.730	0.368	0.001	99.406
JR-MA-128-025	52.825	0.314	1.231	1.251	17.148	20.207	0.115	4.953	0.501	0.000	98.545
JR-MA-128-026	53.374	0.297	3.408	1.429	14.495	21.983	0.128	3.745	1.200	0.000	100.059
JR-MA-128-027	53.163	0.345	1.139	1.087	17.565	19.978	0.136	5.284	0.393	0.000	99.090
JR-MA-128-028	52.988	0.261	1.156	0.925	17.487	21.098	0.147	4.676	0.246	0.000	98.984
JR-MA-130-033	53.146	0.241	1.151	0.823	17.435	21.047	0.150	5.104	0.209	0.000	99.306
JR-MA-130-036	53.744	0.317	0.895	1.127	18.689	18.604	0.167	5.579	0.518	0.001	99.641
JR-MA-130-037	53.209	0.350	0.858	0.960	17.509	19.510	0.163	5.469	0.482	0.000	98.510
JR-MA-130-038	53.707	0.206	1.081	0.883	17.651	21.369	0.129	4.492	0.233	0.005	99.756
JR-MA-133-006	53.125	0.174	0.997	0.780	17.600	21.424	0.133	4.816	0.218	0.000	99.267
JR-MA-133-007	54.247	0.283	0.708	1.044	18.886	18.141	0.177	6.010	0.447	0.000	99.943
JR-MA-134-002	53.223	0.315	1.267	1.252	17.232	19.970	0.149	5.065	0.486	0.008	98.967
JR-MA-134-003	54.084	0.316	1.125	1.157	16.831	20.711	0.126	5.049	0.553	0.000	99.952
JR-MA-134-004	53.156	0.355	1.076	0.936	16.868	20.431	0.137	5.361	0.501	0.000	98.821
JR-MA-140-026	53.178	0.280	1.221	1.410	17.019	20.009	0.127	5.015	0.600	0.002	98.861
JR-MA-141-040	54.269	0.254	0.630	0.913	18.876	18.496	0.175	5.820	0.447	0.000	99.880
JR-MA-141-041	53.847	0.319	0.814	1.154	18.194	19.729	0.136	5.206	0.448	0.000	99.847
JR-MA-144-021	53.397	0.261	0.927	1.226	17.802	19.507	0.144	5.326	0.514	0.003	99.107
JR-MA-147-001	53.078	0.244	1.158	1.302	17.040	20.918	0.119	5.023	0.552	0.000	99.434
JR-MA-147-003	54.394	0.267	0.840	1.169	19.612	17.375	0.170	5.782	0.478	0.000	100.087
JR-MA-147-004	53.726	0.279	0.958	1.153	17.297	20.674	0.140	4.908	0.513	0.006	99.654

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
JR-MA-149-001	53.569	0.181	1.028	0.911	17.735	21.308	0.114	4.450	0.297	0.010	99.603
JR-MA-149-002	53.514	0.363	0.761	0.924	17.728	20.162	0.153	5.553	0.403	0.000	99.561
JR-MA-149-003	54.410	0.074	0.892	0.771	16.230	23.933	0.123	2.976	0.511	0.006	99.926
JR-MA-149-004	54.161	0.356	1.035	1.200	18.184	18.880	0.150	5.586	0.508	0.006	100.066
JR-MA-150-006	52.985	0.196	1.107	0.869	17.359	21.238	0.130	4.842	0.240	0.000	98.966
JR-MA-152-063	53.503	0.358	0.927	1.089	17.334	20.143	0.141	5.195	0.470	0.000	99.160
JR-MA-153-012	53.701	0.257	0.704	0.961	18.504	19.433	0.156	5.409	0.428	0.000	99.553
JR-MA-153-013	54.518	0.277	0.859	0.975	17.888	20.598	0.136	4.870	0.422	0.000	100.543
JR-MA-154-001	54.445	0.318	0.667	1.007	17.893	19.700	0.158	5.337	0.448	0.001	99.974
JR-MA-157-013	53.454	0.357	0.996	1.111	18.038	18.883	0.153	5.746	0.516	0.004	99.258
JR-MA-157-014	53.701	0.331	0.851	1.098	18.198	19.573	0.154	5.357	0.475	0.000	99.738
JR-MA-157-015	53.080	0.426	0.966	0.818	17.320	20.329	0.158	5.711	0.390	0.005	99.203
JR-MA-157-016	53.983	0.402	0.874	0.994	17.698	19.703	0.150	5.564	0.484	0.005	99.857
JR-MA-157-017	53.492	0.276	0.766	1.050	18.543	18.955	0.164	5.393	0.512	0.000	99.151
JR-MA-157-022	54.190	0.402	1.067	0.808	17.380	19.661	0.160	6.097	0.466	0.000	100.231
JR-MA-157-023	53.620	0.353	0.953	1.192	17.387	19.836	0.136	5.232	0.488	0.001	99.198
JR-MA-157-024	53.628	0.305	0.924	1.221	17.531	19.424	0.143	5.560	0.536	0.004	99.276
JR-MA-157-025	53.726	0.352	0.852	1.052	17.384	19.739	0.156	5.512	0.492	0.000	99.265
JR-MA-157-026	53.763	0.352	0.965	1.145	17.641	19.548	0.148	5.630	0.485	0.000	99.677
JR-MA-157-027	53.740	0.366	0.894	1.097	17.374	19.971	0.151	5.442	0.455	0.000	99.490
JR-MA-157-028	53.767	0.364	1.366	1.276	17.222	19.190	0.145	5.290	0.533	0.003	99.156
JR-MA-157-029	53.801	0.328	0.734	0.925	17.249	20.332	0.150	5.276	0.421	0.002	99.218
JR-MA-157-030	53.759	0.375	0.967	1.222	17.537	19.777	0.162	5.267	0.539	0.000	99.605
JR-MA-157-031	53.391	0.330	0.949	1.158	17.656	19.586	0.150	5.300	0.511	0.000	99.031
JR-MA-157-032	53.263	0.447	1.065	1.049	17.101	20.150	0.144	5.669	0.521	0.005	99.414
JR-MA-157-033	53.539	0.298	0.947	1.200	17.784	19.338	0.145	5.499	0.541	0.000	99.291
JR-MA-157-034	53.577	0.288	0.632	0.932	17.962	19.422	0.163	5.417	0.448	0.000	98.841
JR-MA-157-035	53.810	0.321	0.694	0.838	17.370	20.067	0.159	5.437	0.412	0.000	99.108
JR-MA-157-036	53.393	0.319	0.921	1.217	17.512	19.682	0.161	5.262	0.481	0.006	98.954
JR-MA-157-037	53.485	0.351	0.893	1.036	17.500	19.453	0.169	5.701	0.518	0.000	99.106
JR-MA-157-038	52.837	0.594	1.298	0.970	17.007	19.255	0.179	6.808	0.580	0.001	99.529
JR-MA-157-039	53.740	0.335	0.921	1.118	17.515	19.604	0.162	5.567	0.484	0.000	99.446
JR-MA-157-040	53.472	0.380	1.093	1.145	17.432	19.617	0.151	5.862	0.515	0.000	99.667
JR-MA-157-041	53.446	0.322	0.732	0.890	17.539	19.894	0.149	5.459	0.439	0.002	98.872
JR-MA-157-042	53.933	0.338	0.765	1.049	17.663	20.170	0.135	5.165	0.459	0.000	99.677
JR-MA-157-043	53.778	0.353	0.870	1.024	17.755	19.394	0.162	5.525	0.515	0.000	99.376

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
JR-MA-157-044	53.527	0.381	0.946	1.073	17.090	20.309	0.137	5.502	0.476	0.000	99.441
JR-MA-157-045	53.748	0.362	0.951	1.060	17.115	20.483	0.117	5.325	0.437	0.000	99.598
JR-MA-157-046	53.496	0.426	1.020	1.132	17.357	19.554	0.155	5.850	0.496	0.002	99.488
JR-MA-157-047	53.784	0.386	0.889	1.047	17.415	20.271	0.156	5.185	0.480	0.002	99.615
JR-MA-157-048	53.556	0.286	0.806	0.957	17.907	19.571	0.148	5.496	0.485	0.005	99.217
JR-MA-157-049	53.687	0.308	0.921	1.194	18.203	19.785	0.146	5.269	0.477	0.007	99.997
JR-MA-157-050	53.580	0.386	0.994	1.205	17.835	19.817	0.152	5.398	0.522	0.002	99.891
JR-MA-157-051	54.064	0.376	0.963	1.010	18.172	19.149	0.161	5.614	0.448	0.002	99.959
JR-MA-157-052	53.742	0.281	0.829	0.983	17.711	19.537	0.174	5.630	0.478	0.003	99.368
JR-MA-157-053	54.066	0.373	0.847	1.006	17.993	20.013	0.168	5.470	0.478	0.000	100.414
JR-MA-157-054	53.006	0.440	1.035	1.196	17.204	19.702	0.149	5.507	0.481	0.000	98.720
JR-MA-157-055	53.030	0.406	1.100	1.143	17.246	19.607	0.161	5.707	0.499	0.002	98.901
JR-MA-157-056	53.506	0.276	0.865	1.126	17.425	19.969	0.152	5.140	0.468	0.000	98.927
JR-MA-157-057	53.522	0.299	0.922	1.213	18.031	19.094	0.153	5.391	0.458	0.000	99.083
JR-MA-159-002	53.845	0.373	0.929	1.285	17.911	19.254	0.149	5.425	0.488	0.001	99.660
JR-MA-159-003	53.454	0.397	0.957	1.085	17.551	19.027	0.172	5.794	0.479	0.000	98.916
JR-MA-160-022	53.252	0.375	0.948	1.142	17.522	19.455	0.138	5.485	0.511	0.000	98.828
JR-MA-160-023	53.898	0.204	0.578	0.880	18.570	18.721	0.162	5.360	0.425	0.000	98.798
JR-MA-160-024	54.082	0.289	0.691	0.917	17.708	19.620	0.143	5.306	0.420	0.000	99.176
JR-MA-160-025	53.530	0.346	1.029	1.266	17.708	19.533	0.142	5.283	0.498	0.000	99.335
JR-MA-160-026	53.741	0.342	0.881	1.115	17.732	19.541	0.160	5.319	0.459	0.003	99.293
JR-MA-160-027	53.549	0.320	0.862	1.118	17.323	19.561	0.153	5.461	0.468	0.000	98.815
JR-MA-160-028	53.691	0.360	0.704	0.901	17.264	19.904	0.150	5.419	0.442	0.003	98.838
JR-MA-160-029	53.995	0.331	0.870	1.182	17.503	19.710	0.153	5.293	0.443	0.000	99.480
JR-MA-160-030	54.390	0.307	0.719	0.902	17.986	19.470	0.161	5.677	0.468	0.000	100.080
JR-MA-160-031	53.256	0.294	0.886	1.229	17.791	19.770	0.136	5.149	0.458	0.000	98.969
JR-MA-161-002	53.549	0.344	0.961	1.279	17.967	19.138	0.152	5.456	0.526	0.000	99.372
JR-MA-161-003	53.599	0.322	0.882	1.148	18.197	18.775	0.160	5.613	0.475	0.000	99.171
JR-MA-162-001	54.269	0.358	0.932	1.160	17.487	19.628	0.152	5.396	0.461	0.000	99.843
JR-MA-164-001	54.113	0.309	0.883	1.147	17.967	19.223	0.158	5.392	0.462	0.003	99.657
JR-MA-166-001	54.277	0.261	0.710	1.046	18.192	19.400	0.154	5.115	0.427	0.000	99.582
JR-MA-169-002	52.753	0.337	1.125	1.128	17.692	19.296	0.148	5.368	0.413	0.005	98.265
JR-MA-174-062	54.498	0.322	0.926	1.087	18.052	18.669	0.172	5.641	0.460	0.000	99.827
JR-MA-174-063	53.066	0.255	0.939	0.933	17.333	20.377	0.128	5.218	0.460	0.000	98.709
JR-MA-174-064	53.947	0.266	0.826	1.068	17.924	18.943	0.180	5.511	0.514	0.001	99.180
JR-MA-174-065	53.433	0.389	0.936	1.030	17.490	19.370	0.168	5.575	0.517	0.000	98.908

Appendix E. Cr-Diopsides

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	Na2O	K2O	TOTAL
JR-MA-175-013	53.793	0.301	0.877	1.148	18.350	18.289	0.174	5.860	0.504	0.000	99.296
JR-MA-175-014	53.337	0.306	1.106	1.034	18.120	19.050	0.147	5.453	0.394	0.004	98.951
JR-SG-001-015	53.601	0.312	0.866	1.353	17.754	18.876	0.143	5.387	0.520	0.000	98.812
JR-SG-001-043	53.030	0.260	0.854	1.169	18.425	18.178	0.171	5.898	0.498	0.000	98.483
JR-SG-001-044	53.735	0.274	0.711	1.060	18.082	19.552	0.140	5.221	0.444	0.000	99.219
JR-SG-001-045	53.420	0.274	0.739	0.926	18.002	19.932	0.145	4.929	0.385	0.002	98.754
JR-SG-001-046	53.967	0.266	0.736	0.873	18.366	18.928	0.156	5.710	0.467	0.000	99.469
JR-SG-001-047	54.152	0.285	0.827	1.306	18.122	18.894	0.152	5.195	0.456	0.000	99.389
JR-SG-001-049	54.481	0.300	0.725	0.965	18.188	19.906	0.145	5.228	0.453	0.004	100.395
JR-SG-002-044	53.527	0.268	0.993	1.113	17.596	20.166	0.157	4.978	0.375	0.000	99.173
JR-SG-003-036	53.567	0.305	0.896	1.051	18.070	19.682	0.154	5.366	0.505	0.000	99.596
JR-SG-003-038	53.403	0.330	1.125	1.150	16.855	20.817	0.128	4.927	0.504	0.000	99.239
JR-SG-005-007	53.933	0.211	0.905	0.859	17.698	19.558	0.262	5.774	0.415	0.005	99.620
JR-SG-005-008	53.924	0.168	1.088	0.888	17.885	21.221	0.127	4.797	0.258	0.003	100.359
JR-TM-001-016	54.653	0.266	0.726	0.920	18.849	17.975	0.172	5.947	0.449	0.000	99.957
JR-TM-002-001	53.715	0.181	1.552	1.220	17.536	22.900	0.049	2.206	0.191	0.000	99.550
JR-TM-002-004	54.042	0.328	1.042	1.231	18.268	18.668	0.161	5.747	0.520	0.002	100.009
JR-TM-002-005	53.978	0.246	1.084	1.147	17.437	20.570	0.128	5.061	0.560	0.002	100.213
JR-TM-002-006	53.738	0.317	0.863	1.187	17.613	19.913	0.139	5.219	0.481	0.000	99.470
JR-TM-002-007	54.014	0.264	0.812	0.993	18.418	19.264	0.170	5.459	0.480	0.000	99.874
LOW CR DIOPSIDE (NON KIMBERLITIC)											
(Cr_2O_3 < 0.5 wt%)											
JR-MA-018-106	52.985	0.075	1.680	0.435	15.923	23.338	0.118	3.784	0.485	0.003	98.826
JR-MA-065-030	53.439	0.050	1.334	0.384	15.854	22.777	0.171	5.143	0.663	0.004	99.819
JR-MA-107-001	53.593	0.212	1.570	0.465	16.844	22.601	0.096	3.830	0.505	0.005	99.721
JR-MA-130-035	54.821	0.000	0.481	0.196	15.094	23.649	0.147	4.627	0.933	0.006	99.954
JR-MA-141-004	54.918	0.065	0.061	0.010	17.116	24.599	0.211	2.651	0.285	0.003	99.919
JR-MA-141-039	54.697	0.019	0.874	0.304	17.932	23.941	0.076	1.689	0.240	0.000	99.772
HIGH CR DIOPSIDE (NON KIMBERLITIC)											
(Cr_2O_3 > 1.5 wt%)											
JR-MA-018-112	52.835	0.203	3.051	1.840	18.142	19.318	0.126	4.064	0.695	0.004	100.278
JR-MA-025-042	53.780	0.078	1.774	1.627	17.833	20.625	0.073	2.607	0.714	0.009	99.120

Appendix E. Ilmenites

Sample	SiO_2	TiO_2	Nb_2O_5	Al_2O_3	Cr_2O_3	V_2O_5	MgO	MnO	FeO^*	NiO	ZnO	Total	Fe_2O_3	FeO	Total
KIMBERLITIC ILMENITES															
JR-MA-015-013	0.009	43.686	0.123	0.206	0.343	0.533	5.390	0.231	47.789	0.012	0.007	98.329	19.310	30.414	100.264
JR-MA-018-060	0.000	44.677	0.099	0.238	0.331	0.542	5.839	0.243	46.643	0.013	0.001	98.626	17.969	30.475	100.426
JR-MA-095-002	0.022	44.698	0.249	0.140	1.200	0.384	5.870	0.279	45.338	0.045	0.019	98.244	16.719	30.294	99.919
JR-MA-023-014	0.042	44.509	0.173	0.183	0.592	0.727	6.093	0.249	45.996	0.031	0.017	98.612	17.493	30.256	100.365
JR-MA-006-018	0.006	46.308	0.122	0.248	0.356	0.427	6.212	0.216	45.035	0.015	0.001	98.946	15.428	31.152	100.492
JR-MA-160-008	0.025	46.431	0.103	0.243	0.534	0.448	6.267	0.243	44.052	0.010	0.035	98.391	14.341	31.148	99.828
JR-MA-018-044	0.043	45.788	0.204	0.293	0.348	0.524	6.356	0.243	45.452	0.004	0.010	99.265	16.406	30.690	100.909
JR-SG-001-022	0.048	45.934	0.028	0.268	0.394	0.522	6.484	0.262	44.753	0.017	0.017	98.727	15.987	30.367	100.329
JR-MA-018-046	0.021	46.580	0.114	0.283	0.361	0.377	6.512	0.261	44.288	0.027	0.003	98.827	15.064	30.734	100.336
JR-MA-018-041	0.032	46.909	0.075	0.287	0.360	0.431	6.523	0.252	43.965	0.022	0.026	98.882	14.342	31.060	100.319
JR-SG-001-017	0.053	46.261	0.088	0.275	0.328	0.435	6.525	0.240	44.457	0.013	0.000	98.675	15.441	30.563	100.222
JR-MA-018-079	0.024	46.355	0.080	0.298	0.371	0.450	6.679	0.247	43.965	0.022	0.008	98.499	15.153	30.331	100.017
JR-MA-018-085d	0.026	46.656	0.091	0.295	0.329	0.436	6.757	0.271	43.589	0.014	0.002	98.466	14.610	30.443	99.930
JR-MA-018-084	0.019	45.757	0.244	0.223	0.459	0.593	6.824	0.256	44.090	0.011	0.032	98.508	15.757	29.912	100.087
JR-MA-018-085	0.020	46.679	0.076	0.281	0.369	0.464	6.868	0.236	43.495	0.018	0.014	98.520	14.656	30.308	99.988
JR-MA-015-007	0.034	47.389	0.097	0.308	0.349	0.369	6.912	0.252	43.026	0.015	0.029	98.780	13.664	30.731	100.149
JR-MA-101-018	0.079	47.645	0.174	0.350	0.074	0.353	6.953	0.296	42.591	0.007	0.025	98.547	12.919	30.966	99.841
JR-MA-007-053	0.017	48.024	0.067	0.307	0.323	0.428	6.964	0.245	42.985	0.028	0.013	99.401	13.033	31.258	100.707
JR-SG-001-023	0.056	47.723	0.073	0.297	0.333	0.361	7.016	0.230	42.284	0.035	0.005	98.413	12.699	30.858	99.685
JR-SG-001-019	0.041	47.675	0.032	0.317	0.360	0.408	7.222	0.298	42.174	0.023	0.014	98.564	13.092	30.394	99.876
JR-MA-007-055	0.035	47.974	0.116	0.353	0.317	0.358	7.366	0.293	42.591	0.032	0.018	99.453	13.544	30.404	100.810
JR-MA-020-008	0.022	47.685	0.108	0.333	0.310	0.425	7.421	0.300	42.458	0.028	0.026	99.116	13.715	30.117	100.490
JR-MA-029-008	0.013	48.150	0.065	0.371	0.360	0.381	7.433	0.277	41.833	0.013	0.013	98.909	12.665	30.437	100.178
JR-MA-094-011	0.021	48.278	0.123	0.413	0.054	0.279	7.490	0.287	41.624	0.008	0.025	98.602	12.535	30.345	99.858
JR-MA-006-020	0.041	48.433	0.062	0.331	0.346	0.326	7.548	0.261	41.804	0.036	0.022	99.210	12.656	30.416	100.478
JR-MA-018-058	0.026	48.637	0.079	0.376	0.421	0.399	7.573	0.264	41.493	0.027	0.003	99.298	12.003	30.693	100.501
JR-MA-003-010	0.026	48.764	0.086	0.364	0.325	0.253	7.677	0.277	41.447	0.034	0.011	99.264	12.309	30.371	100.497
JR-MA-095-004	0.064	48.697	0.217	0.208	1.209	0.313	7.742	0.295	39.902	0.047	0.026	98.720	10.523	30.433	99.774
JR-MA-015-017	0.037	48.751	0.058	0.382	0.543	0.354	7.745	0.289	41.042	0.040	0.029	99.270	11.886	30.347	100.461
JR-MA-015-008	0.014	48.321	0.045	0.379	0.584	0.353	7.761	0.250	41.731	0.045	0.015	99.498	13.108	29.936	100.811
JR-MA-006-015	0.013	48.939	0.122	0.404	0.332	0.389	7.769	0.253	41.320	0.014	0.018	99.573	11.869	30.641	100.762
JR-MA-018-065	0.038	45.571	0.438	0.130	4.015	0.622	7.879	0.288	40.379	0.065	0.004	99.429	13.665	28.083	100.798
JR-MA-094-006	0.035	45.794	0.510	0.078	2.192	0.430	7.889	0.288	40.819	0.038	0.013	98.086	14.185	28.055	99.507
JR-SG-001-020	0.035	49.068	0.116	0.323	0.641	0.407	7.950	0.291	40.421	0.033	0.018	99.303	11.109	30.425	100.416
JR-MA-023-008	0.033	48.966	0.103	0.253	0.405	0.396	8.079	0.259	40.793	0.024	0.015	99.326	11.868	30.114	100.515
JR-MA-018-051	0.050	49.235	0.120	0.372	0.312	0.407	8.108	0.253	40.893	0.022	0.005	99.777	11.687	30.377	100.948
JR-MA-023-009	0.032	48.836	0.090	0.327	0.563	0.451	8.114	0.242	40.819	0.039	0.028	99.541	12.027	29.997	100.746
JR-MA-006-013	0.022	49.762	0.000	0.494	0.121	0.369	8.234	0.273	40.146	0.018	0.010	99.449	10.851	30.382	100.536
JR-MA-018-063	0.033	48.682	0.045	0.401	0.351	0.415	8.269	0.226	40.562	0.032	0.009	99.025	12.274	29.518	100.255
JR-MA-003-009	0.014	48.444	0.090	0.315	0.327	0.362	8.282	0.244	41.164	0.046	0.015	99.303	13.312	29.186	100.637
JR-MA-018-055	0.075	50.032	0.114	0.531	0.205	0.331	8.326	0.257	38.905	0.052	0.029	98.857	9.280	30.554	99.787
JR-SG-001-016	0.045	49.692	0.064	0.483	0.129	0.323	8.373	0.261	39.566	0.025	0.017	98.978	10.526	30.095	100.033
JR-MA-018-062	0.013	49.341	0.088	0.399	0.255	0.314	8.379	0.301	40.444	0.038	0.004	99.576	11.940	29.700	100.772
JR-MA-015-003	0.052	49.756	0.090	0.451	0.164	0.335	8.397	0.260	40.339	0.017	0.012	99.873	11.292	30.178	101.004
JR-SG-001-025	0.057	49.702	0.032	0.500	0.131	0.409	8.397	0.265	39.263	0.030	0.017	98.803	10.108	30.168	99.816

Appendix E. Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-006-014	0.033	50.076	0.043	0.530	0.074	0.340	8.423	0.277	39.654	0.026	0.016	99.492	10.368	30.325	100.531
JR-MA-018-056	0.033	50.200	0.009	0.505	0.118	0.285	8.460	0.282	39.652	0.035	0.000	99.579	10.452	30.247	100.626
JR-SG-001-002	0.032	50.082	0.000	0.518	0.121	0.245	8.479	0.284	38.705	0.032	0.007	98.505	9.644	30.027	99.471
JR-MA-015-015	0.016	47.521	0.258	0.228	1.857	0.461	8.483	0.294	39.870	0.067	0.021	99.076	12.900	28.262	100.368
JR-MA-018-047	0.008	50.104	0.071	0.535	0.107	0.324	8.486	0.291	39.440	0.031	0.006	99.403	10.266	30.202	100.432
JR-SG-001-026	0.035	50.049	0.067	0.516	0.139	0.328	8.503	0.272	39.148	0.048	0.003	99.108	9.986	30.162	100.109
JR-MA-018-066	0.035	50.269	0.000	0.470	0.099	0.273	8.541	0.282	39.531	0.035	0.026	99.561	10.464	30.115	100.609
JR-MA-017-010	0.033	50.551	0.071	0.339	0.625	0.345	8.585	0.269	39.328	0.038	0.013	100.197	9.811	30.500	101.180
JR-MA-006-016	0.038	50.269	0.000	0.522	0.104	0.348	8.588	0.264	39.509	0.027	0.010	99.679	10.353	30.194	100.716
JR-MA-018-075	0.036	50.072	0.032	0.543	0.128	0.300	8.594	0.250	38.980	0.049	0.011	98.995	10.031	29.954	100.000
JR-MA-018-077	0.050	49.656	0.019	0.528	0.111	0.301	8.606	0.270	39.714	0.027	0.022	99.304	11.291	29.554	100.435
JR-MA-018-054	0.027	50.281	0.045	0.517	0.186	0.318	8.656	0.268	39.625	0.036	0.011	99.970	10.632	30.058	101.035
JR-MA-018-076	0.039	49.726	0.026	0.536	0.170	0.239	8.662	0.245	39.459	0.045	0.019	99.166	11.152	29.425	100.283
JR-MA-018-043	0.032	50.307	0.103	0.536	0.122	0.348	8.704	0.271	38.885	0.019	0.024	99.351	9.748	30.114	100.328
JR-MA-007-057	0.018	50.522	0.075	0.560	0.120	0.301	8.757	0.278	38.766	0.031	0.019	99.447	9.657	30.077	100.415
JR-MA-018-050	0.047	50.517	0.095	0.575	0.156	0.277	8.844	0.227	38.905	0.039	0.036	99.718	9.936	29.965	100.713
JR-MA-018-045	0.009	50.332	0.052	0.593	0.194	0.342	8.876	0.240	38.864	0.028	0.019	99.549	10.113	29.765	100.562
JR-MA-007-039	0.039	49.988	0.060	0.444	0.113	0.353	8.898	0.309	39.054	0.036	0.033	99.327	10.742	29.388	100.403
JR-MA-006-019	0.031	50.423	0.062	0.563	0.162	0.330	8.917	0.284	38.393	0.047	0.000	99.212	9.610	29.745	100.175
JR-MA-015-012	0.039	50.497	0.071	0.585	0.149	0.313	8.927	0.238	38.735	0.051	0.003	99.608	9.900	29.827	100.600
JR-MA-018-061	0.021	50.671	0.000	0.492	0.375	0.328	8.986	0.269	38.703	0.049	0.005	99.899	9.925	29.772	100.893
JR-MA-018-083	0.031	50.288	0.011	0.581	0.159	0.259	8.993	0.255	38.348	0.036	0.010	98.971	9.997	29.352	99.973
JR-MA-007-013	0.021	50.548	0.384	0.170	0.455	0.330	9.049	0.306	38.476	0.030	0.012	99.781	9.484	29.942	100.731
JR-MA-018-067	0.009	49.101	0.054	0.436	0.405	0.379	9.320	0.264	39.241	0.043	0.020	99.272	12.618	27.887	100.536
JR-SG-001-021	0.037	51.500	0.000	0.460	0.372	0.352	9.341	0.262	36.984	0.034	0.033	99.375	7.830	29.939	100.159
JR-MA-094-010	0.044	50.472	0.000	0.706	0.057	0.226	9.366	0.239	37.746	0.048	0.008	98.912	9.930	28.811	99.907
JR-MA-094-007	0.036	50.711	0.056	0.280	0.088	0.240	9.383	0.217	37.795	0.055	0.023	98.884	9.695	29.071	99.855
JR-MA-007-034	0.060	51.079	0.002	0.613	0.206	0.313	9.433	0.242	37.745	0.052	0.035	99.780	9.312	29.366	100.713
JR-MA-094-046	0.078	50.941	0.060	0.678	0.096	0.270	9.453	0.251	36.912	0.082	0.005	98.826	8.559	29.211	99.684
JR-MA-018-081	0.052	50.460	0.017	0.581	0.202	0.282	9.461	0.270	37.730	0.077	0.015	99.147	10.055	28.682	100.154
JR-MA-094-045	0.050	50.593	0.071	0.648	0.116	0.252	9.464	0.225	37.271	0.061	0.029	98.780	9.355	28.853	99.717
JR-MA-017-023	0.053	50.715	0.022	0.621	0.194	0.341	9.466	0.281	38.064	0.050	0.014	99.821	10.053	29.018	100.828
JR-MA-160-007	0.054	51.638	0.137	0.364	0.205	0.292	9.737	0.288	36.281	0.027	0.024	99.047	7.626	29.419	99.811
JR-MA-022-006	0.071	51.796	0.116	0.395	0.220	0.288	9.802	0.281	36.585	0.021	0.008	99.583	7.914	29.464	100.376
JR-MA-018-073	0.018	51.847	0.155	0.473	0.601	0.304	9.818	0.285	36.713	0.073	0.006	100.293	8.091	29.433	101.104
JR-MA-018-069	0.026	51.433	0.045	0.511	0.381	0.243	9.832	0.278	36.963	0.055	0.008	99.775	9.013	28.853	100.678
JR-MA-030-003	0.053	51.440	0.180	0.315	0.343	0.305	9.884	0.281	37.600	0.022	0.033	100.456	9.503	29.049	101.408
JR-MA-017-013	0.052	50.802	0.015	0.679	0.156	0.281	9.949	0.257	37.196	0.064	0.033	99.484	10.080	28.126	100.494
JR-MA-017-014	0.052	51.300	0.131	0.334	0.541	0.262	9.958	0.289	36.525	0.061	0.018	99.471	8.766	28.637	100.349
JR-MA-018-057	0.039	50.898	0.107	0.580	0.382	0.540	9.966	0.325	36.827	0.040	0.015	99.719	9.093	28.645	100.630
JR-MA-018-068	0.035	49.322	0.285	0.194	4.274	0.221	10.011	0.380	34.964	0.115	0.001	99.802	9.166	26.716	100.720
JR-MA-057-004	0.009	51.425	0.186	0.229	0.758	0.450	10.042	0.297	36.386	0.041	0.002	99.825	8.286	28.930	100.655
JR-MA-007-033	0.029	52.334	0.315	0.182	0.518	0.305	10.053	0.300	35.859	0.032	0.016	99.943	6.894	29.655	100.634
JR-MA-018-052	0.030	52.595	0.036	0.451	0.175	0.317	10.135	0.275	36.119	0.032	0.008	100.173	7.362	29.495	100.911
JR-MA-114-003	0.047	51.723	0.028	0.458	0.119	0.306	10.143	0.266	36.063	0.059	0.011	99.223	8.215	28.671	100.046
JR-MA-018-070	0.016	52.163	0.094	0.290	0.364	0.391	10.185	0.361	36.401	0.049	0.008	100.322	8.140	29.077	101.138

Appendix E. Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-023-011	0.042	51.788	0.073	0.403	0.244	0.363	10.234	0.323	35.580	0.038	0.026	99.114	7.702	28.649	99.886
JR-MA-007-043	0.023	53.026	0.049	0.441	0.234	0.264	10.291	0.268	35.307	0.068	0.002	99.973	6.449	29.504	100.619
JR-MA-037-011	0.010	51.414	0.114	0.165	1.235	0.300	10.356	0.326	35.442	0.098	0.017	99.477	8.327	27.949	100.311
JR-MA-007-054	0.026	53.046	0.099	0.246	0.244	0.241	10.399	0.293	34.823	0.072	0.045	99.534	6.156	29.284	100.151
JR-MA-023-015	0.068	52.174	0.121	0.482	0.233	0.236	10.406	0.305	35.467	0.053	0.014	99.559	7.646	28.587	100.325
JR-MA-057-003	0.037	52.014	0.121	0.263	0.658	0.470	10.455	0.295	35.420	0.048	0.013	99.794	7.464	28.704	100.542
JR-MA-023-019	0.009	51.721	0.082	0.495	0.422	0.209	10.480	0.264	35.306	0.063	0.016	99.067	8.206	27.922	99.889
JR-MA-018-072	0.029	52.718	0.131	0.395	0.267	0.423	10.501	0.317	35.348	0.042	0.024	100.195	6.882	29.156	100.884
JR-MA-022-001	0.041	52.556	0.204	0.295	1.117	0.276	10.509	0.283	34.647	0.079	0.038	100.045	6.450	28.843	100.691
JR-MA-007-008	0.053	52.472	0.366	0.180	0.604	0.262	10.584	0.291	35.215	0.037	0.010	100.074	7.064	28.859	100.782
JR-MA-007-016	0.021	52.987	0.118	0.272	0.742	0.270	10.584	0.266	34.781	0.059	0.005	100.105	6.384	29.037	100.745
JR-MA-007-050	0.034	52.944	0.308	0.203	0.665	0.316	10.600	0.295	34.331	0.056	0.000	99.752	5.657	29.241	100.319
JR-MA-023-017	0.037	52.213	0.073	0.480	0.306	0.289	10.606	0.312	35.013	0.045	0.017	99.391	7.507	28.258	100.143
JR-MA-025-018	0.032	50.593	0.002	0.886	0.419	0.585	10.616	0.244	36.357	0.036	0.021	99.791	10.129	27.242	100.806
JR-MA-023-023	0.018	52.578	0.381	0.211	0.659	0.289	10.617	0.308	34.600	0.042	0.010	99.713	6.346	28.890	100.349
JR-MA-023-022	0.035	52.512	0.097	0.440	0.353	0.381	10.629	0.242	34.805	0.048	0.010	99.552	6.752	28.729	100.229
JR-MA-007-035	0.028	52.637	0.356	0.191	0.632	0.214	10.649	0.315	34.952	0.044	0.005	100.023	6.895	28.748	100.714
JR-MA-007-017	0.013	52.882	0.276	0.217	0.700	0.247	10.671	0.318	34.366	0.044	0.033	99.767	6.131	28.849	100.381
JR-MA-007-007	0.031	52.918	0.167	0.310	1.085	0.241	10.703	0.293	34.157	0.065	0.006	99.976	6.012	28.748	100.578
JR-MA-030-005	0.040	51.790	0.175	0.310	0.369	0.242	10.728	0.330	35.771	0.066	0.000	99.821	8.996	27.677	100.722
JR-MA-007-058	0.038	53.400	0.148	0.269	0.750	0.213	10.764	0.268	34.424	0.058	0.018	100.350	5.986	29.037	100.950
JR-MA-007-006	0.022	53.216	0.189	0.374	0.900	0.195	10.823	0.258	34.181	0.079	0.006	100.243	6.020	28.764	100.846
JR-MA-007-021	0.051	52.523	0.144	0.390	1.144	0.193	10.924	0.270	34.278	0.096	0.025	100.038	7.090	27.899	100.748
JR-MA-007-041	0.020	53.000	0.084	0.344	1.124	0.215	10.965	0.287	33.693	0.082	0.022	99.836	6.120	28.186	100.449
JR-MA-007-059	0.028	52.932	0.375	0.246	0.794	0.281	11.031	0.288	34.060	0.049	0.016	100.100	6.210	28.472	100.722
JR-MA-007-049	0.028	52.889	0.326	0.208	0.799	0.234	11.036	0.328	33.859	0.047	0.013	99.767	6.221	28.261	100.390
JR-MA-023-018	0.021	53.129	0.168	0.440	0.345	0.310	11.041	0.287	34.020	0.047	0.000	99.808	6.177	28.462	100.427
JR-MA-007-052	0.021	53.169	0.401	0.233	0.816	0.274	11.082	0.305	33.609	0.071	0.022	100.003	5.612	28.559	100.565
JR-MA-015-005	0.017	53.380	0.028	0.508	0.348	0.256	11.114	0.262	34.225	0.048	0.006	100.192	6.546	28.335	100.848
JR-MA-017-011	0.021	52.006	0.142	0.654	0.799	0.195	11.125	0.258	34.108	0.123	0.013	99.444	7.858	27.037	100.231
JR-MA-112-001	0.040	52.974	0.026	0.601	0.468	0.282	11.141	0.252	33.441	0.083	0.002	99.310	6.082	27.968	99.919
JR-MA-091-001	0.059	50.625	0.116	0.240	0.628	0.286	11.162	0.342	35.647	0.056	0.000	99.161	10.853	25.881	100.248
JR-MA-098-003	0.045	52.742	0.253	0.323	0.419	0.269	11.215	0.240	33.507	0.049	0.010	99.072	6.235	27.896	99.697
JR-MA-007-036	0.023	52.670	0.375	0.199	0.617	0.307	11.238	0.294	34.202	0.043	0.027	99.995	7.012	27.892	100.698
JR-MA-007-028	0.030	53.156	0.210	0.272	0.901	0.247	11.348	0.270	32.990	0.065	0.005	99.494	5.667	27.891	100.062
JR-MA-007-046	0.054	52.707	0.360	0.172	0.618	0.329	11.432	0.342	33.705	0.040	0.008	99.767	6.777	27.607	100.446
JR-MA-007-010	0.033	53.662	0.347	0.240	0.831	0.254	11.516	0.288	32.963	0.058	0.022	100.214	5.312	28.183	100.746
JR-MA-030-004	0.034	51.941	0.146	0.351	0.357	0.218	11.552	0.466	34.334	0.061	0.026	99.486	9.138	26.112	100.402
JR-MA-007-037	0.028	53.362	0.307	0.257	0.932	0.213	11.561	0.296	33.116	0.077	0.022	100.171	6.027	27.693	100.775
JR-MA-023-020	0.042	53.712	0.138	0.437	0.169	0.321	11.627	0.335	33.097	0.062	0.000	99.940	5.788	27.889	100.520
JR-MA-057-002	0.017	50.764	0.303	0.290	0.485	0.304	11.664	0.232	35.323	0.049	0.022	99.453	11.038	25.391	100.559
JR-MA-007-023	0.011	53.587	0.283	0.253	0.953	0.203	11.695	0.320	32.455	0.072	0.026	99.858	5.428	27.571	100.402
JR-MA-007-015	0.039	54.027	0.077	0.585	0.785	0.218	11.752	0.276	32.805	0.109	0.010	100.683	5.648	27.723	101.249
JR-MA-007-012	0.039	53.478	0.197	0.297	1.257	0.308	11.809	0.275	32.468	0.079	0.004	100.211	5.594	27.435	100.771
JR-MA-029-007	0.013	51.985	0.177	0.425	2.888	0.377	11.971	0.265	31.472	0.142	0.008	99.723	6.297	25.806	100.354
JR-MA-007-009	0.016	53.285	0.257	0.240	0.806	0.316	12.016	0.343	32.624	0.060	0.014	99.977	6.380	26.883	100.616

Appendix E. Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-007-026	0.021	53.725	0.116	0.333	1.002	0.218	12.083	0.297	31.780	0.098	0.003	99.676	5.448	26.878	100.222
JR-MA-018-042	0.024	53.289	0.075	0.482	0.172	0.270	12.172	0.307	32.889	0.083	0.000	99.763	7.239	26.375	100.488
JR-MA-007-014	0.005	53.965	0.240	0.304	1.233	0.234	12.174	0.291	31.577	0.088	0.028	100.139	5.014	27.065	100.641
JR-MA-007-018	0.045	54.127	0.116	0.592	0.449	0.187	12.194	0.298	32.080	0.095	0.014	100.197	5.631	27.013	100.761
JR-MA-007-022	0.041	54.538	0.099	0.497	0.283	0.214	12.222	0.279	32.072	0.092	0.014	100.351	5.221	27.374	100.874
JR-MA-023-012	0.028	52.702	0.192	0.470	2.437	0.255	12.225	0.252	30.935	0.125	0.006	99.627	5.628	25.871	100.191
JR-MA-007-056	0.029	54.074	0.170	0.448	1.066	0.380	12.363	0.243	31.461	0.098	0.010	100.342	4.886	27.065	100.831
JR-MA-007-048	0.042	54.046	0.167	0.366	1.044	0.240	12.406	0.301	31.381	0.096	0.006	100.095	5.201	26.701	100.616
JR-MA-007-011	0.012	54.187	0.154	0.339	0.785	0.254	12.459	0.333	31.677	0.070	0.029	100.299	5.556	26.678	100.856
JR-MA-007-020	0.033	53.715	0.114	0.453	0.634	0.247	12.516	0.259	31.920	0.084	0.004	99.979	6.350	26.206	100.615
JR-MA-007-019	0.022	53.655	0.275	0.349	1.713	0.188	12.560	0.257	31.263	0.099	0.034	100.415	5.735	26.103	100.990
JR-MA-007-029	0.047	54.091	0.176	0.367	1.321	0.255	12.638	0.253	30.796	0.098	0.025	100.067	4.889	26.397	100.557
JR-MA-007-044	0.037	54.219	0.296	0.310	0.863	0.335	13.060	0.211	30.795	0.092	0.021	100.239	5.266	26.056	100.767
JR-MA-007-024	0.047	54.139	0.174	0.439	1.441	0.271	13.203	0.305	30.008	0.085	0.000	100.112	5.078	25.439	100.621
JR-MA-007-051	0.037	55.433	0.137	0.628	0.641	0.193	13.536	0.222	29.203	0.138	0.018	100.186	3.725	25.851	100.559
CRUSTAL ILMENITES															
JR-MA-025-025	0.013	50.392	0.004	0.010	0.037	0.043	0.008	3.077	45.961	0.002	0.017	99.564	4.119	42.255	99.977
JR-TM-002-024	0.081	50.085	0.042	0.014	0.016	0.002	0.014	3.106	44.834	0.006	0.015	98.215	3.156	41.995	98.531
JR-MA-094-012	0.041	48.735	0.064	0.007	0.033	0.325	0.021	2.749	47.515	0.009	0.032	99.531	6.576	41.598	100.190
JR-MA-094-013	0.038	50.710	0.434	0.008	0.025	0.000	0.022	1.770	47.008	0.000	0.028	100.043	3.055	44.259	100.349
JR-MA-015-010	0.031	50.375	0.095	0.000	0.021	0.043	0.039	1.692	47.154	0.000	0.013	99.463	3.824	43.713	99.846
JR-MA-104-006	0.011	50.041	0.097	0.026	0.009	0.124	0.039	5.340	43.410	0.002	0.003	99.102	3.978	39.831	99.501
JR-MA-018-086	0.015	46.746	0.017	0.026	0.092	0.266	0.050	2.474	48.998	0.020	0.011	98.715	10.145	39.869	99.731
JR-MA-148-023	0.050	49.989	0.059	0.014	0.041	0.015	0.059	3.527	44.868	0.000	0.048	98.670	3.876	41.380	99.058
JR-MA-104-004	0.045	49.820	0.061	0.001	0.023	0.039	0.067	3.715	45.610	0.000	0.006	99.387	5.018	41.095	99.890
JR-MA-094-018	0.050	46.679	0.026	0.000	0.036	0.376	0.069	1.978	50.033	0.000	0.000	99.247	10.559	40.532	100.305
JR-MA-015-011	0.022	51.072	0.116	0.011	0.009	0.012	0.072	1.350	47.040	0.009	0.037	99.750	2.756	44.560	100.026
JR-MA-073-019	0.021	51.520	0.000	0.021	0.000	0.000	0.119	0.893	47.270	0.000	0.038	99.882	2.296	45.204	100.112
JR-MA-025-039	0.034	42.902	0.068	0.013	0.012	0.048	0.138	1.625	53.450	0.000	0.107	98.397	18.522	36.783	100.253
JR-MA-095-011	0.054	51.182	0.104	0.006	0.009	0.073	0.154	0.792	47.497	0.000	0.027	99.898	2.534	45.217	100.152
JR-MA-167-004	0.002	50.729	0.000	0.018	0.019	0.081	0.177	0.733	47.696	0.025	0.015	99.495	3.382	44.653	99.834
JR-MA-109-001	0.013	51.278	0.061	0.024	0.028	0.049	0.209	0.742	47.475	0.003	0.025	99.907	2.615	45.122	100.169
JR-SG-002-004	0.101	52.932	0.000	0.000	0.019	0.000	0.218	9.733	36.835	0.000	0.005	99.843	0.000	36.835	99.843
JR-MA-115-001	0.025	51.868	0.027	0.049	0.024	0.078	0.263	0.910	46.781	0.001	0.028	100.054	1.525	45.409	100.207
JR-MA-018-082	0.000	51.195	0.153	0.031	0.017	0.015	0.266	0.722	47.356	0.000	0.044	99.799	2.638	44.982	100.063
JR-MA-010-001	0.017	53.016	0.027	0.008	0.013	0.000	0.333	4.085	42.916	0.013	0.000	100.428	0.000	42.916	100.428
JR-MA-023-016	0.019	53.194	0.053	0.001	0.007	0.000	0.336	8.010	38.575	0.004	0.009	100.208	0.000	38.575	100.208
JR-SG-003-034	0.052	51.451	0.000	0.004	0.000	0.015	0.423	0.666	47.247	0.011	0.026	99.895	2.618	44.891	100.157
JR-MA-005-001	0.037	51.035	0.074	0.035	0.000	0.033	0.443	0.705	47.384	0.018	0.035	99.799	3.185	44.518	100.118
JR-SG-002-003	0.046	51.415	0.114	0.041	0.014	0.032	0.475	0.694	47.080	0.011	0.060	99.982	2.477	44.851	100.230
JR-MA-128-005	0.012	51.354	0.008	0.007	0.009	0.171	0.502	0.960	47.097	0.018	0.029	100.167	2.816	44.563	100.449
JR-MA-160-014	0.036	51.570	0.000	0.033	0.005	0.000	0.545	0.803	46.640	0.004	0.035	99.671	2.269	44.598	99.898
JR-MA-037-015	0.015	50.688	0.023	0.025	0.008	0.033	0.555	0.534	47.877	0.000	0.040	99.798	4.185	44.111	100.217
JR-MA-076-003	0.035	51.729	0.023	0.020	0.010	0.000	0.585	0.660	46.341	0.005	0.044	99.452	1.680	44.829	99.620
JR-MA-073-010	0.030	51.783	0.030	0.007	0.000	0.070	0.616	0.714	46.395	0.000	0.047	99.692	1.681	44.882	99.860

Appendix E. Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NIO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-030-014	0.041	52.156	0.102	0.067	0.028	0.000	0.617	0.711	46.462	0.006	0.031	100.221	1.394	45.208	100.361
JR-MA-029-011	0.021	51.946	0.028	0.051	0.022	0.000	0.623	0.845	46.565	0.000	0.021	100.122	1.980	44.783	100.320
JR-MA-046-005	0.026	51.646	0.070	0.049	0.021	0.016	0.626	0.696	46.854	0.004	0.030	100.038	2.367	44.724	100.275
JR-MA-007-060	0.015	51.266	0.000	0.005	0.030	0.141	0.628	0.660	47.078	0.003	0.008	99.834	2.816	44.544	100.116
JR-SG-003-035	0.034	51.608	0.025	0.055	0.047	0.117	0.737	0.684	46.474	0.000	0.021	99.802	2.042	44.636	100.007
JR-MA-029-013	0.038	51.847	0.028	0.029	0.012	0.000	0.746	0.797	45.434	0.013	0.028	98.972	1.010	44.525	99.073
JR-MA-045-002	0.020	51.773	0.004	0.032	0.025	0.089	0.747	0.686	46.368	0.003	0.006	99.753	1.863	44.692	99.940
JR-MA-078-024	0.039	51.658	0.000	0.034	0.023	0.153	0.756	0.682	46.449	0.007	0.019	99.820	1.966	44.680	100.017
JR-MA-094-016	0.044	52.473	0.083	0.029	0.000	0.011	0.773	0.917	45.611	0.000	0.031	99.972	0.665	45.012	100.039
JR-MA-037-019	0.020	52.297	0.004	0.025	0.000	0.029	0.793	0.791	46.038	0.005	0.034	100.036	1.317	44.853	100.168
JR-MA-078-025	0.009	51.827	0.000	0.041	0.034	0.000	0.823	0.793	46.000	0.016	0.013	99.556	1.868	44.320	99.743
JR-MA-037-024	0.027	52.428	0.000	0.021	0.012	0.059	0.830	0.800	45.586	0.000	0.039	99.802	0.710	44.948	99.873
JR-MA-160-009	0.011	52.560	0.013	0.048	0.000	0.037	0.831	0.709	45.762	0.000	0.028	99.999	0.706	45.127	100.070
JR-MA-015-004	0.044	52.108	0.025	0.055	0.027	0.038	0.835	0.672	46.223	0.012	0.048	100.087	1.609	44.775	100.248
JR-MA-073-002	0.020	51.169	0.051	0.040	0.017	0.060	0.839	0.660	45.899	0.016	0.029	98.800	2.129	43.983	99.013
JR-MA-030-013	0.035	52.124	0.000	0.036	0.019	0.003	0.863	0.839	45.966	0.000	0.032	99.917	1.626	44.503	100.080
JR-MA-076-031	0.042	51.968	0.000	0.046	0.019	0.000	0.918	0.738	45.507	0.007	0.020	99.265	1.258	44.375	99.391
JR-TM-002-012	0.054	51.618	0.021	0.057	0.008	0.053	0.959	0.620	46.049	0.000	0.013	99.452	2.010	44.240	99.653
JR-MA-018-053	0.032	51.837	0.028	0.065	0.023	0.050	0.964	0.664	46.346	0.015	0.000	100.024	2.210	44.357	100.245
JR-MA-003-011	0.031	51.870	0.038	0.024	0.012	0.045	0.982	0.615	46.600	0.001	0.027	100.245	2.450	44.396	100.490
JR-MA-026-003	0.021	52.240	0.000	0.053	0.000	0.000	0.997	0.731	45.461	0.001	0.003	99.507	1.089	44.481	99.616
JR-MA-018-048	0.031	51.760	0.004	0.053	0.015	0.142	1.005	0.640	46.562	0.008	0.003	100.223	2.446	44.361	100.468
JR-SG-002-010	0.033	51.553	0.038	0.026	0.025	0.055	1.020	0.699	45.840	0.000	0.021	99.310	2.065	43.982	99.517
JR-SG-002-011	0.043	50.946	0.070	0.070	0.016	0.060	1.025	0.828	46.889	0.006	0.026	99.979	3.943	43.341	100.374
JR-MA-080-020	0.024	52.323	0.002	0.068	0.009	0.007	1.031	0.636	45.665	0.000	0.009	99.774	1.179	44.604	99.892
JR-MA-141-026	0.019	51.983	0.025	0.073	0.022	0.061	1.043	0.701	45.681	0.000	0.018	99.626	1.527	44.307	99.779
JR-MA-027-006	0.014	52.643	0.030	0.022	0.012	0.051	1.051	0.780	45.660	0.004	0.021	100.288	0.974	44.784	100.386
JR-MA-023-032	0.022	52.721	0.091	0.030	0.000	0.003	1.068	0.801	45.450	0.000	0.013	100.199	0.708	44.813	100.270
JR-MA-082-004	0.014	51.612	0.017	0.041	0.029	0.062	1.084	0.674	46.238	0.008	0.001	99.780	2.574	43.922	100.038
JR-MA-037-021	0.022	52.156	0.034	0.064	0.020	0.106	1.095	0.690	45.753	0.017	0.003	99.960	1.434	44.463	100.104
JR-MA-025-035	0.010	52.623	0.000	0.051	0.022	0.004	1.112	0.829	45.370	0.000	0.016	100.037	0.962	44.504	100.133
JR-MA-141-007	0.009	52.437	0.000	0.033	0.000	0.110	1.121	0.687	45.353	0.001	0.024	99.775	0.811	44.623	99.856
JR-MA-083-018	0.004	51.477	0.011	0.085	0.011	0.183	1.144	0.693	46.296	0.012	0.035	99.951	2.759	43.814	100.227
JR-MA-001-002	0.018	52.329	0.025	0.045	0.007	0.000	1.166	3.160	43.438	0.042	0.016	100.246	1.851	41.772	100.431
JR-MA-174-057	0.019	51.564	0.000	0.012	0.011	0.091	1.173	0.656	45.928	0.005	0.010	99.469	2.402	43.767	99.710
JR-TM-002-003	0.059	51.661	0.049	0.013	0.014	0.144	1.198	0.630	45.703	0.000	0.027	99.498	1.881	44.010	99.686
JR-MA-023-010	0.040	52.742	0.057	0.074	0.01C	0.004	1.200	0.690	45.457	0.002	0.025	100.301	0.860	44.683	100.387
JR-SG-001-028	0.039	52.036	0.068	0.046	0.010	0.134	1.205	0.570	46.086	0.011	0.040	100.245	1.924	44.355	100.438
JR-MA-080-023	0.035	52.443	0.000	0.030	0.016	0.115	1.265	0.635	45.371	0.000	0.012	99.922	0.996	44.475	100.022
JR-MA-063-014	0.021	51.956	0.013	0.006	0.027	0.088	1.277	0.646	46.014	0.000	0.027	100.075	2.298	43.946	100.305
JR-MA-007-032	0.027	52.206	0.013	0.069	0.016	0.044	1.337	0.633	45.501	0.000	0.032	99.878	1.657	44.010	100.044
JR-SG-001-027	0.053	52.237	0.032	0.055	0.041	0.216	1.346	0.651	45.326	0.004	0.025	99.986	1.107	44.329	100.097
JR-MA-007-038	0.033	52.677	0.047	0.047	0.023	0.000	1.368	0.746	45.057	0.000	0.028	100.026	0.906	44.242	100.117
JR-MA-025-040	0.026	52.068	0.045	0.068	0.034	0.092	1.384	0.645	45.739	0.000	0.004	100.105	2.017	43.924	100.307
JR-MA-128-011	0.045	52.192	0.006	0.038	0.000	0.011	1.398	0.679	45.286	0.000	0.030	99.685	1.645	43.806	99.850
JR-MA-017-012	0.034	52.680	0.028	0.082	0.019	0.037	1.405	0.669	45.359	0.000	0.022	100.335	1.176	44.301	100.453

Appendix E. Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-018-074	0.031	52.369	0.000	0.075	0.000	0.110	1.423	0.603	45.701	0.007	0.018	100.337	1.741	44.135	100.511
JR-MA-073-014	0.015	52.123	0.044	0.060	0.007	0.083	1.435	0.645	44.701	0.005	0.040	99.158	0.982	43.818	99.256
JR-MA-160-011	0.024	53.124	0.066	0.063	0.011	0.000	1.441	0.739	44.817	0.000	0.056	100.341	0.346	44.506	100.376
JR-MA-078-017	0.000	51.944	0.030	0.029	0.024	0.062	1.442	0.641	45.170	0.002	0.043	99.387	1.765	43.582	99.564
JR-SG-002-005	0.004	52.071	0.000	0.081	0.017	0.122	1.457	0.646	44.946	0.000	0.017	99.361	1.322	43.757	99.493
JR-MA-145-003	0.051	51.858	0.057	0.074	0.016	0.164	1.488	0.599	45.412	0.000	0.010	99.729	1.849	43.748	99.914
JR-MA-018-049	0.004	52.870	0.042	0.069	0.025	0.141	1.517	0.645	45.143	0.000	0.034	100.490	0.793	44.430	100.569
JR-MA-141-009	0.036	52.364	0.078	0.061	0.029	0.058	1.519	0.657	44.675	0.007	0.033	99.517	0.862	43.899	99.603
JR-SG-003-033	0.052	52.556	0.093	0.060	0.015	0.099	1.519	0.671	45.105	0.006	0.026	100.202	1.045	44.165	100.307
JR-MA-001-001	0.026	52.191	0.000	0.046	0.018	0.082	1.543	0.645	45.224	0.009	0.021	99.805	1.735	43.663	99.979
JR-MA-141-027	0.028	52.218	0.000	0.065	0.022	0.216	1.550	0.567	45.311	0.000	0.006	99.983	1.468	43.990	100.130
JR-MA-030-016	0.033	51.566	0.072	0.104	0.002	0.041	1.559	0.604	45.573	0.008	0.000	99.562	2.687	43.155	99.831
JR-MA-076-033	0.018	52.250	0.006	0.122	0.008	0.171	1.564	0.629	45.392	0.014	0.049	100.223	1.766	43.803	100.400
JR-MA-037-016	0.008	52.082	0.000	0.081	0.013	0.116	1.581	0.617	45.340	0.000	0.022	99.860	1.972	43.566	100.058
JR-MA-153-004	0.031	50.634	0.019	0.084	0.065	0.210	1.597	0.521	46.303	0.008	0.048	99.520	4.228	42.498	99.944
JR-MA-160-013	0.022	52.037	0.038	0.089	0.038	0.060	1.597	0.632	45.088	0.000	0.014	99.615	1.811	43.458	99.796
JR-MA-005-002	0.001	51.693	0.030	0.063	0.008	0.074	1.608	0.722	45.554	0.000	0.038	99.791	2.833	43.005	100.075
JR-MA-130-032	0.044	52.296	0.040	0.067	0.018	0.110	1.620	0.574	45.167	0.014	0.021	99.971	1.523	43.797	100.124
JR-MA-149-007	0.036	51.610	0.015	0.061	0.023	0.229	1.627	0.546	45.426	0.004	0.053	99.630	2.331	43.328	99.864
JR-MA-046-001	0.042	52.797	0.006	0.019	0.023	0.146	1.666	0.718	44.332	0.000	0.057	99.806	0.348	44.019	99.841
JR-MA-128-004	0.028	52.090	0.097	0.074	0.013	0.071	1.668	0.652	45.105	0.014	0.044	99.856	1.887	43.407	100.045
JR-MA-056-003	0.052	52.397	0.017	0.052	0.001	0.118	1.676	0.635	44.998	0.000	0.021	99.967	1.402	43.737	100.107
JR-MA-153-011	0.028	51.337	0.000	0.044	0.026	0.179	1.676	0.603	45.368	0.009	0.048	99.318	2.818	42.833	99.600
JR-MA-023-013	0.041	51.527	0.004	0.052	0.030	0.065	1.689	0.676	45.640	0.016	0.015	99.755	3.191	42.769	100.075
JR-MA-077-027	0.011	52.079	0.017	0.068	0.013	0.197	1.710	0.641	45.085	0.000	0.020	99.841	1.805	43.461	100.022
JR-SG-002-012	0.025	52.295	0.000	0.104	0.007	0.054	1.713	0.673	44.831	0.004	0.015	99.721	1.601	43.390	99.881
JR-MA-110-002	0.036	52.008	0.000	0.099	0.000	0.104	1.723	0.620	45.200	0.000	0.001	99.791	2.138	43.276	100.005
JR-MA-160-012	0.029	51.924	0.036	0.047	0.000	0.015	1.755	0.671	44.950	0.008	0.013	99.448	2.207	42.964	99.669
JR-MA-026-004	0.028	52.196	0.043	0.040	0.005	0.105	1.758	0.651	45.126	0.002	0.040	99.994	1.970	43.354	100.191
JR-SG-003-004	0.052	52.189	0.000	0.040	0.040	0.110	1.760	0.605	45.106	0.002	0.039	99.943	1.917	43.381	100.135
JR-SG-006-001	0.037	52.304	0.025	0.064	0.027	0.094	1.766	0.618	44.877	0.008	0.031	99.851	1.590	43.446	100.010
JR-MA-094-015	0.009	52.461	0.000	0.081	0.021	0.069	1.771	0.661	44.902	0.007	0.028	100.010	1.627	43.438	100.173
JR-MA-061-005	0.000	50.473	0.032	0.102	0.022	0.199	1.778	0.625	45.916	0.001	0.028	99.176	4.452	41.910	99.622
JR-MA-065-026	0.035	51.286	0.019	0.073	0.025	0.102	1.786	0.603	45.884	0.002	0.040	99.855	3.748	42.512	100.230
JR-MA-094-014	0.046	51.597	0.000	0.085	0.037	0.255	1.804	0.521	45.476	0.011	0.038	99.870	2.674	43.070	100.138
JR-MA-144-004	0.030	51.264	0.064	0.080	0.013	0.211	1.814	0.598	45.370	0.012	0.050	99.506	3.030	42.644	99.810
JR-MA-037-022	0.026	49.750	0.028	0.046	0.067	0.379	1.839	0.460	46.827	0.009	0.039	99.470	5.796	41.612	100.051
JR-SG-002-001	0.017	52.388	0.017	0.069	0.025	0.083	1.839	0.705	44.589	0.000	0.023	99.755	1.468	43.268	99.902
JR-MA-026-005	0.000	49.514	0.000	0.078	0.041	0.281	1.849	0.475	46.802	0.000	0.048	99.088	6.280	41.151	99.717
JR-MA-029-010	0.010	52.726	0.006	0.092	0.038	0.160	1.858	0.615	45.087	0.000	0.009	100.601	1.493	43.743	100.751
JR-MA-078-026	0.026	52.054	0.000	0.084	0.035	0.222	1.861	0.619	45.169	0.007	0.030	100.107	2.172	43.215	100.325
JR-MA-077-026	0.021	51.890	0.000	0.058	0.022	0.165	1.879	0.623	45.604	0.002	0.036	100.300	2.966	42.935	100.597
JR-MA-007-025	0.019	52.744	0.057	0.062	0.023	0.078	1.892	0.675	44.517	0.012	0.028	100.107	1.079	43.546	100.215
JR-MA-078-027	0.000	52.281	0.008	0.054	0.014	0.146	1.897	0.602	44.858	0.014	0.029	99.903	1.816	43.224	100.085
JR-MA-076-030	0.000	52.483	0.053	0.067	0.002	0.036	1.924	0.651	44.699	0.000	0.025	99.940	1.666	43.199	100.107
JR-MA-065-022	0.000	52.947	0.021	0.037	0.006	0.161	1.947	0.615	44.470	0.000	0.027	100.231	0.774	43.773	100.309

Appendix E. Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-094-017	0.019	51.583	0.004	0.093	0.000	0.086	1.953	0.608	44.975	0.006	0.023	99.350	2.832	42.427	99.634
JR-MA-007-047	0.029	52.542	0.057	0.084	0.025	0.040	1.957	0.647	44.811	0.000	0.041	100.233	1.758	43.229	100.409
JR-MA-073-006	0.019	52.270	0.000	0.074	0.052	0.111	1.976	0.630	44.697	0.016	0.025	99.870	1.880	43.005	100.058
JR-MA-175-012	0.036	51.557	0.000	0.074	0.033	0.152	1.983	0.586	45.201	0.011	0.005	99.638	2.998	42.504	99.938
JR-MA-149-009	0.031	51.983	0.006	0.049	0.018	0.177	1.989	0.523	44.910	0.003	0.019	99.708	2.150	42.975	99.923
JR-MA-077-025	0.029	52.505	0.000	0.090	0.033	0.145	2.007	0.628	44.902	0.005	0.001	100.345	1.824	43.261	100.528
JR-SG-002-006	0.035	52.163	0.000	0.091	0.029	0.128	2.009	0.600	44.624	0.011	0.021	99.711	1.877	42.935	99.899
JR-MA-078-023	0.045	52.426	0.006	0.047	0.052	0.232	2.028	0.556	44.594	0.005	0.030	100.021	1.369	43.363	100.158
JR-MA-003-012	0.012	51.963	0.004	0.087	0.042	0.149	2.032	0.597	44.854	0.000	0.021	99.761	2.352	42.738	99.997
JR-MA-073-009	0.175	51.500	0.000	0.128	0.043	0.187	2.033	0.555	45.232	0.011	0.044	99.908	2.945	42.582	100.203
JR-TM-002-028	0.042	51.105	0.000	0.057	0.033	0.171	2.047	0.508	45.566	0.009	0.040	99.578	3.885	42.070	99.967
JR-MA-037-020	0.045	52.312	0.023	0.075	0.011	0.243	2.089	0.619	44.715	0.005	0.022	100.159	1.761	43.130	100.335
JR-SG-002-013	0.039	51.860	0.000	0.105	0.009	0.137	2.089	0.570	44.909	0.001	0.015	99.734	2.584	42.584	99.993
JR-MA-130-031	0.020	52.051	0.000	0.065	0.024	0.099	2.097	0.554	45.161	0.014	0.038	100.123	2.799	42.642	100.403
JR-MA-083-014	0.004	52.873	0.030	0.045	0.023	0.180	2.110	0.593	44.018	0.011	0.024	99.911	0.603	43.475	99.971
JR-MA-160-010	0.044	51.761	0.000	0.081	0.052	0.113	2.114	0.605	45.077	0.000	0.034	99.881	3.011	42.367	100.183
JR-MA-042-003	0.039	52.360	0.059	0.094	0.021	0.198	2.121	0.617	44.668	0.012	0.018	100.207	1.769	43.076	100.384
JR-MA-017-028	0.047	52.262	0.047	0.053	0.020	0.077	2.125	0.623	44.521	0.001	0.011	99.787	1.916	42.797	99.979
JR-MA-007-040	0.023	52.210	0.000	0.079	0.042	0.178	2.144	0.625	44.814	0.000	0.024	100.139	2.256	42.784	100.365
JR-MA-161-001	0.022	52.464	0.000	0.073	0.055	0.129	2.173	0.613	44.313	0.000	0.021	99.863	1.574	42.897	100.021
JR-MA-076-034	0.015	52.135	0.013	0.108	0.045	0.231	2.185	0.548	44.567	0.004	0.020	99.871	1.954	42.809	100.067
JR-MA-080-002	0.017	51.910	0.021	0.079	0.030	0.162	2.188	0.568	44.546	0.015	0.036	99.572	2.320	42.459	99.804
JR-MA-083-019	0.018	51.242	0.000	0.094	0.029	0.288	2.220	0.536	45.073	0.000	0.019	99.519	3.370	42.040	99.857
JR-MA-056-004	0.019	51.957	0.008	0.108	0.008	0.107	2.246	0.610	44.770	0.010	0.007	99.850	2.760	42.287	100.127
JR-MA-073-012	0.042	51.826	0.000	0.111	0.045	0.099	2.249	0.574	44.661	0.011	0.027	99.645	2.749	42.188	99.920
JR-MA-024-003	0.022	52.278	0.075	0.081	0.036	0.214	2.266	0.561	44.992	0.006	0.014	100.545	2.400	42.832	100.785
JR-SG-001-032	0.073	52.226	0.000	0.096	0.042	0.199	2.303	0.563	44.014	0.005	0.018	99.539	1.493	42.671	99.689
JR-SG-002-014	0.027	51.916	0.002	0.095	0.028	0.163	2.303	0.554	44.486	0.009	0.038	99.621	2.463	42.270	99.868
JR-SG-001-029	0.056	52.174	0.034	0.071	0.011	0.225	2.313	0.540	44.399	0.001	0.012	99.836	1.892	42.696	100.026
JR-MA-157-012	0.023	52.423	0.000	0.065	0.008	0.082	2.323	0.600	44.079	0.013	0.017	99.633	1.729	42.524	99.806
JR-MA-037-025	0.032	52.083	0.000	0.064	0.049	0.169	2.346	0.554	44.790	0.003	0.021	100.111	2.681	42.378	100.380
JR-MA-106-002	0.045	52.694	0.000	0.086	0.053	0.266	2.371	0.582	44.299	0.000	0.033	100.429	1.427	43.015	100.572
JR-MA-037-018	0.028	52.110	0.000	0.097	0.063	0.145	2.373	0.504	44.524	0.006	0.022	99.872	2.407	42.358	100.113
JR-MA-094-008	0.045	51.787	0.070	0.131	0.031	0.235	2.396	0.545	44.759	0.020	0.030	100.049	2.841	42.203	100.334
JR-MA-029-012	0.013	52.278	0.000	0.073	0.036	0.203	2.415	0.574	44.543	0.024	0.023	100.182	2.361	42.419	100.419
JR-MA-007-042	0.012	52.122	0.057	0.090	0.034	0.166	2.423	0.645	44.790	0.005	0.000	100.344	2.842	42.233	100.629
JR-MA-128-015	0.047	49.593	0.096	0.097	0.037	0.382	2.443	0.470	46.219	0.005	0.050	99.439	6.376	40.482	100.078
JR-MA-015-009	0.017	52.060	0.023	0.069	0.043	0.199	2.453	0.531	44.742	0.003	0.022	100.162	2.777	42.243	100.440
JR-MA-023-021	0.011	51.596	0.041	0.127	0.041	0.157	2.464	0.545	44.706	0.007	0.030	99.725	3.311	41.727	100.057
JR-MA-037-017	0.026	51.852	0.040	0.079	0.013	0.150	2.465	0.642	44.526	0.021	0.018	99.832	2.963	41.860	100.129
JR-MA-015-014	0.025	52.398	0.025	0.098	0.018	0.184	2.466	0.577	44.398	0.000	0.021	100.210	2.144	42.469	100.425
JR-MA-160-015	0.041	52.025	0.000	0.059	0.045	0.168	2.483	0.520	44.307	0.000	0.008	99.656	2.409	42.139	99.897
JR-MA-025-038	0.000	52.859	0.000	0.099	0.041	0.120	2.505	0.619	43.545	0.000	0.024	99.812	1.038	42.611	99.916
JR-MA-065-025	0.041	49.213	0.038	0.112	0.076	0.425	2.528	0.449	46.210	0.026	0.018	99.136	6.884	40.016	99.826
JR-MA-112-002	0.040	52.388	0.000	0.114	0.025	0.157	2.541	0.535	43.586	0.000	0.027	99.413	1.416	42.312	99.555
JR-MA-025-037	0.021	52.227	0.000	0.124	0.006	0.188	2.545	0.579	44.131	0.003	0.020	99.844	2.207	42.145	100.065

Appendix E. Ilmenites

Sample	SiO2	TiO2	Nb2O5	Al2O3	Cr2O3	V2O5	MgO	MnO	FeO*	NiO	ZnO	Total	Fe2O3	FeO	Total
JR-MA-128-014	0.056	49.702	0.000	0.138	0.069	0.379	2.551	0.472	46.193	0.011	0.021	99.592	6.541	40.307	100.247
JR-MA-128-001	0.029	49.464	0.053	0.121	0.061	0.392	2.560	0.474	46.257	0.013	0.020	99.444	6.821	40.120	100.127
JR-MA-042-002	0.022	51.935	0.000	0.069	0.052	0.301	2.564	0.554	44.634	0.000	0.026	100.157	2.870	42.051	100.445
JR-SG-003-032	0.030	51.823	0.015	0.102	0.065	0.310	2.567	0.528	44.167	0.002	0.024	99.633	2.396	42.011	99.873
JR-MA-025-034	0.031	52.319	0.015	0.086	0.008	0.115	2.570	0.507	44.083	0.000	0.023	99.757	2.127	42.169	99.970
JR-MA-030-015	0.014	52.100	0.000	0.101	0.018	0.110	2.570	0.563	44.398	0.001	0.027	99.902	2.813	41.867	100.184
JR-MA-101-004	0.033	51.761	0.028	0.117	0.062	0.166	2.611	0.523	44.175	0.004	0.018	99.498	2.777	41.676	99.776
JR-MA-046-009	0.044	52.160	0.004	0.082	0.041	0.310	2.624	0.490	44.201	0.014	0.022	99.992	2.172	42.246	100.210
JR-SG-002-026	0.042	51.584	0.053	0.093	0.055	0.168	2.655	0.554	44.366	0.021	0.024	99.615	3.267	41.426	99.942
JR-MA-025-036	0.023	52.462	0.000	0.071	0.034	0.244	2.663	0.597	43.817	0.010	0.021	99.942	1.785	42.211	100.121
JR-MA-140-003	0.021	51.961	0.000	0.092	0.037	0.348	2.667	0.533	44.168	0.003	0.020	99.850	2.423	41.988	100.093
JR-MA-141-011	0.053	52.254	0.036	0.093	0.059	0.231	2.669	0.565	43.887	0.004	0.041	99.892	1.999	42.088	100.092
JR-MA-022-004	0.047	52.019	0.017	0.124	0.023	0.210	2.671	0.514	44.174	0.015	0.021	99.835	2.559	41.871	100.091
JR-MA-076-032	0.025	52.733	0.023	0.096	0.045	0.157	2.692	0.514	43.665	0.012	0.026	99.988	1.438	42.371	100.132
JR-SG-001-031	0.028	51.505	0.000	0.126	0.051	0.215	2.692	0.504	44.669	0.000	0.043	99.833	3.696	41.343	100.203
JR-MA-065-027	0.017	51.589	0.026	0.065	0.032	0.218	2.693	0.492	44.270	0.000	0.031	99.433	3.123	41.460	99.746
JR-MA-006-049	0.028	52.652	0.047	0.097	0.037	0.203	2.697	0.565	43.595	0.000	0.013	99.934	1.370	42.363	100.071
JR-MA-080-016	0.032	52.381	0.000	0.090	0.000	0.153	2.699	0.511	44.321	0.000	0.008	100.195	2.525	42.049	100.448
JR-MA-024-002	0.026	51.486	0.036	0.130	0.051	0.297	2.716	0.528	44.272	0.004	0.042	99.588	3.167	41.422	99.905
JR-SG-001-030	0.051	52.345	0.053	0.097	0.048	0.228	2.718	0.585	43.784	0.022	0.032	99.963	1.911	42.064	100.154
JR-MA-065-023	0.039	52.514	0.042	0.079	0.038	0.257	2.747	0.589	43.976	0.000	0.020	100.301	1.961	42.212	100.497
JR-MA-094-005	0.026	51.776	0.019	0.113	0.033	0.212	2.754	0.539	43.943	0.011	0.022	99.448	2.757	41.463	99.724
JR-MA-076-006	0.014	52.294	0.000	0.072	0.045	0.106	2.765	0.529	44.098	0.017	0.005	99.945	2.636	41.726	100.209
JR-MA-065-024	0.026	51.996	0.030	0.075	0.078	0.339	2.780	0.533	43.927	0.010	0.017	99.811	2.322	41.838	100.044
JR-MA-022-003	0.030	52.430	0.036	0.124	0.029	0.154	2.798	0.510	43.678	0.005	0.015	99.809	1.926	41.945	100.002
JR-MA-018-078	0.027	52.103	0.013	0.088	0.062	0.282	2.801	0.546	43.628	0.002	0.032	99.584	2.064	41.771	99.791
JR-MA-022-002	0.014	52.207	0.030	0.100	0.028	0.265	2.842	0.537	43.760	0.000	0.039	99.822	2.209	41.772	100.043
JR-MA-027-007	0.042	52.634	0.023	0.104	0.022	0.194	2.847	0.554	43.553	0.002	0.018	99.993	1.659	42.060	100.159
JR-MA-130-030	0.025	50.670	0.000	0.147	0.078	0.426	2.879	0.419	44.805	0.031	0.028	99.508	4.608	40.659	99.970
JR-MA-156-002	0.050	52.371	0.021	0.098	0.050	0.282	2.884	0.508	43.663	0.014	0.020	99.961	1.917	41.938	100.153
JR-MA-018-064	0.038	52.640	0.051	0.097	0.032	0.108	2.888	0.533	44.184	0.015	0.000	100.586	2.531	41.907	100.840
JR-MA-078-001	0.034	52.307	0.000	0.068	0.044	0.273	2.898	0.499	44.117	0.004	0.017	100.261	2.552	41.821	100.517
JR-MA-095-005	0.056	51.649	0.045	0.095	0.036	0.262	2.898	0.493	43.853	0.014	0.031	99.432	2.870	41.271	99.720
JR-TM-002-002	0.017	52.171	0.000	0.114	0.025	0.195	2.898	0.488	43.918	0.006	0.008	99.840	2.607	41.572	100.101
JR-TM-002-025	0.005	51.990	0.000	0.107	0.060	0.112	2.923	0.541	44.128	0.000	0.020	99.886	3.298	41.161	100.216
JR-MA-094-009	0.038	52.418	0.021	0.082	0.047	0.292	3.044	0.514	43.539	0.007	0.040	100.042	2.067	41.679	100.249
JR-MA-024-001	0.019	51.962	0.004	0.097	0.040	0.266	3.053	0.512	43.979	0.005	0.028	99.965	3.104	41.186	100.276
JR-MA-022-005	0.051	42.742	0.138	0.408	0.029	0.132	3.192	0.348	51.077	0.021	0.026	98.164	20.345	32.771	100.202
JR-MA-037-023	0.028	51.980	0.000	0.101	0.122	0.360	3.450	0.434	43.400	0.008	0.027	99.910	2.971	40.726	100.208
JR-SG-002-009	0.034	51.521	0.000	0.118	0.068	0.380	3.941	0.402	43.205	0.008	0.000	99.677	4.080	39.534	100.086

Appendix E. Olivine

Sample	SiO2	TiO2	Al2O3	Cr2O3	MgO	CaO	MnO	FeO	CoO	NiO	Total
OLIVINE FROM MAFIC OR KIMBERLITIC SOURCES											
JR-MA-003-007	40.625	0.020	0.004	0.010	48.305	0.017	0.166	10.467	0.010	0.338	99.962
JR-MA-003-035	41.550	0.003	0.000	0.000	51.833	0.002	0.088	6.007	0.013	0.381	99.877
JR-MA-066-001	41.072	0.020	0.037	0.098	49.278	0.095	0.118	9.170	0.008	0.328	100.224
JR-SG-001-004	41.290	0.017	0.000	0.019	50.855	0.009	0.106	6.699	0.020	0.347	99.362
JR-SG-001-005	40.399	0.000	0.000	0.003	48.757	0.012	0.169	9.212	0.018	0.327	98.897
JR-SG-001-006	40.590	0.019	0.003	0.014	48.858	0.021	0.146	9.410	0.010	0.307	99.378
JR-SG-001-007	40.880	0.017	0.002	0.012	48.570	0.017	0.161	9.036	0.022	0.383	99.100
JR-SG-001-008	41.000	0.015	0.004	0.006	50.520	0.008	0.124	7.122	0.024	0.340	99.163
JR-SG-001-009	41.317	0.000	0.000	0.006	51.621	0.007	0.091	5.809	0.017	0.325	99.193
JR-SG-001-039	40.879	0.000	0.001	0.000	50.260	0.005	0.128	7.517	0.011	0.326	99.127
JR-SG-001-040	40.318	0.005	0.002	0.002	47.418	0.010	0.193	10.799	0.024	0.298	99.069
JR-SG-001-041	41.113	0.024	0.003	0.006	50.733	0.011	0.134	7.399	0.020	0.371	99.814

Appendix I

Metamorphic/Magmatic Massive Sulphide Indicator Mineral Data Picking Results

Summary List of Abbreviations

Cpy	Chalcopyrite	Ky	Kyanite
Moly	Molybdenite	Sill	Sillimanite
Py	Pyrite	St	Staurolite
Gth	Goethite	Sps	Spessartine
Sp	Spinel	Fay	Fayalite
Cr-Diop	Chrome Diopside	Opx	Orthopyroxene
RedRut	Red Rutile	Chr	Chromite
Cor	Corundum	Mn-Epi	Manganese Epidote
Uva	Uvarovite	Cr-Gros	Chromium Grossular
sap	Sapharine	Tr	trace
gr	grain(s)		

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-001	Tr (1 gr)	0	Tr (2 gr)	0	0	Tr low-Cr diopside (3 gr)	0	0	0	0	0	0	0	0	0
JR-MA-002	0	0	Tr (1 gr)	0	0	Tr low-Cr diopside (2 gr)	0	0	Tr	Tr	0	0	0	0	0
JR-MA-003	0	0	0	0	0	Tr low-Cr diopside (18 gr)	0	0	0	Tr	0	0	Tr	Tr (2 gr; see KIM data)	0
JR-MA-004	0	0	0	0	0	Tr low-Cr diopside (4 gr)	0	0	0	Tr	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-005	0	0	0	0	0	Tr low-Cr diopside (8 gr)	0	0	0	Tr	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-006	0	0	0	0	1 green	Tr low-Cr diopside (8 gr)	0	0	0	Tr	0	0	0	Tr (19 gr; see KIM data)	0
JR-MA-007	0	0	Tr (1 gr)	0	0	0	0	0	Tr	Tr	Tr	0	0	Tr (21 gr; see KIM data)	0
JR-MA-008	0	0	0	15	0	Tr low-Cr diopside (4 gr)	0	0	0	0	0	0	40	0	0
JR-MA-009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-010	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	0	0	0	2	0	0
JR-MA-011	0	0	0	0	0	0	0	0	0	0	0	0	Tr	0	0
JR-MA-012	0	0	0	0	0	Tr low-Cr diopside (5 gr)	0	0	0	Tr	0	0	Tr	0	0
JR-MA-013	0	0	0	0	0	0	0	0	Tr	0	0	0	1	0	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-014	0	0	0	Tr	0	Tr low-Cr diopside (4 gr)	0	0	Tr	Tr	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-015	0	0	0	Tr	0	Tr low-Cr diopside (3 gr)	0	0	0	0.5	0	0	Tr	Tr (5 gr; see KIM data)	0
JR-MA-016	0	0	0	Tr	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	Tr	0	0
JR-MA-017	Tr (1 gr)	0	0.3 (~35 gr)	Tr	0	Tr low-Cr diopside (6 gr)	0	0	0	Tr	Tr	0	Tr	Tr (12 gr; see KIM data)	0
JR-MA-018	0	0	Tr (1 gr)	Tr	0	Tr low-Cr diopside (27 gr)	0	0	Tr	0.5	Tr	0	Tr	Tr (7 gr; see KIM data)	0
JR-MA-019	0	0	0	0	0	0	0	0	Tr	0	0	0	0	0	0
JR-MA-020	0	0	Tr (2 gr)	Tr	0	Tr low-Cr diopside (2 gr)	0	0	0	Tr	Tr	0	0	0	0
JR-MA-021	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-022	0	0	0	Tr	0	Tr low-Cr diopside (2 gr)	0	0	0	0	0	15	20	Tr (2 gr; see KIM data)	0
JR-MA-023	Tr (1 gr)	0	Tr (3 gr)	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	1	0	Tr (7 gr; see KIM data)	0
JR-MA-024	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	Tr	0	0	0	0	0
JR-MA-025	0	0	0	0	0	Tr low-Cr diopside (9 gr)	0	0	0	Tr	0	0	Tr	Tr (15 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-026	Tr (1 gr)	0	0	0	0	Tr low-Cr diopside (11 gr)	0	0	0	0	Tr	Tr	0	Tr (4 gr; see KIM data)	0
JR-MA-027	0	0	0	0	0	0	0	0	0	0	0	0	0	Tr (4 gr; see KIM data)	0
JR-MA-028	0	0	Tr (10 gr)	0	0	Tr low-Cr diopside (5 gr)	0	0	0	0	0	0	0	Tr (1 gr; see KIM data)	0
JR-MA-029	Tr (1 gr)	1 native silver-bearing lithic	Tr (2 gr)	0	0	Tr low-Cr diopside (10 gr)	0	0	0	Tr	0	0	0	Tr (1 gr; see KIM data)	0
JR-MA-030	0	0	0	2	0	Tr low-Cr diopside (2 gr)	0	0	0	0	0	0	0	Tr (7 gr; see KIM data)	0
JR-MA-031	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-032	0	0	0	0	0	Tr psilomelane (~50 gr)	0	0	0	0	0	0	70	0	0
JR-MA-033	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-034	0	0	1 (5 gr)	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-035	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-037	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	Tr	0	0	Tr (~75 gr; see KIM data)	0
JR-MA-038	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	35	Tr (1 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-039	0	0	0	0	0	Tr low-Cr diopside (13 gr)	0	0	0	0	0	0	2	Tr (1 gr; see KIM data)	0
JR-MA-040	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-041	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	0	0	0	Tr	0	0
JR-MA-042	0	0	Tr (3 gr)	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	Tr	Tr (4 gr; see KIM data)	0
JR-MA-043	0	0	5 (~15 gr)	0	0	0	0	0	0	0	0	0	1	0	0
JR-MA-044	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
JR-MA-045	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	5	Tr (4 gr; see KIM data)	0
JR-MA-046	Tr (1 gr)	0	Tr (7 gr)	0	0	0	0	0	0	0	Tr	0	2	Tr (8 gr; see KIM data)	0
JR-MA-047	0	0	0	0	0	0	0	0	0	0	0	0	Tr	Tr (2 gr; see KIM data)	0
JR-MA-048	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0
JR-MA-049	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	5	0	0
JR-MA-050	Tr (2 gr)	0	0	0	1 blue-green gahnite	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	2	Tr (~120 gr; see KIM data)	0
JR-MA-051	0	0	0	0	0	0	0	0	Tr	Tr	0	0	10	Tr (2 gr; see KIM data)	0
JR-MA-052	0	0	0	0	0	0	0	Tr	0	0	0	0	0	0	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-053	0	0	0	0	0	Tr low-Cr diopside (6 gr)	0	0	0	1	0	0	0	0	0
JR-MA-054	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-055	0	0	0	Tr	0	0	0	0	0	0	0	0	10	0	0
JR-MA-056	0	0	0	0	0	Tr low-Cr diopside (5 gr)	0	0	0	Tr	0	0	2	Tr (1 gr; see KIM data)	0
JR-MA-057	0	0	0	95	0	0	0	Tr	0	Tr	0	0	2	0	0
JR-MA-058	0	0	0	10	0	0	0	0	0	0	Tr	0	2	0	0
JR-MA-059	0	0	0	0	0	0	0	0	0	0	0	0	90	Tr (1 gr; see KIM data)	0
JR-MA-060	0	0	0	0	0	0	0	0	0	0	0	0	15	Tr (1 gr; see KIM data)	0
JR-MA-061	Tr (1 gr)	Tr bornite (6 gr)	Tr (5 gr)	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	Tr	0	2	Tr (6 gr; see KIM data)	0
JR-MA-062	Tr (1 gr)	0	Tr (8 gr)	0	0	0	0	0	0	0	0	0	60	0	0
JR-MA-063	0	0	Tr (10 gr)	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	Tr	0	50	Tr (14 gr; see KIM data)	0
JR-MA-064	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0
JR-MA-065	Tr (1 gr)	0	0	0	0	Tr low-Cr diopside (5 gr)	0	0	0	Tr	0	0	60	Tr (~60 gr; see KIM data)	0
JR-MA-066	0	0	0	0	0	0	0	0	0	Tr	0	0	0	0	0
JR-MA-067	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-068	0	0	0	0	0	0	0	0	0	0	0	0	Tr	Tr (2 gr; see KIM data)	0

Appendix I. **MMSIM picking results**

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-069	0	0	0	0	0	0	0	0	0	0	0	0	0	Tr (1 gr; see KIM data)	0
JR-MA-070	0	0	0	0	0	0	0	0	0	Tr	0	0	Tr	0	0
JR-MA-071	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	Tr	0	0	0	0	0	0	0
JR-MA-072	0	0	0	0	0	0	0	0	0	0	0	0	0	Tr (7 gr; see KIM data)	0
JR-MA-073	0	0	0	Tr	0	Tr low-Cr diopside (9 gr)	0	0	0	1	0	0	0	Tr (25 gr; see KIM data)	0
JR-MA-074	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	Tr	0	0
JR-MA-075	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	5	0	0
JR-MA-076	Tr (1 gr)	0	0	0	0	Tr low-Cr diopside (3 gr)	0	Tr	0	0	Tr	0	Tr	Tr (~50 gr; see KIM data)	0
JR-MA-077	Tr (1 gr)	0	0	0	0	Tr low-Cr diopside (5 gr)	0	0	0	0	Tr	0	Tr	Tr (~200 gr; see KIM data)	0
JR-MA-078	0	0	0	0	0	Tr low-Cr diopside (3 gr)	0	Tr	0	0	0	0	Tr	Tr (~50 gr; see KIM data)	0
JR-MA-079	0	0	0	0	0	0	0	0	Tr	0	0	0	0	Tr (1 gr; see KIM data)	0

Appendix I. **MMSIM picking results**

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-080	0	0	0	0	0	Tr low-Cr diopside (6 gr)	0	0	0	0	Tr	0	0	Tr (~60 gr; see KIM data)	0
JR-MA-081	0	0	0	0	0	0	0	0	0	Tr	0	0	Tr	Tr (12 gr; see KIM data)	0
JR-MA-082	0	0	0	Tr	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	2	Tr (1 gr; see KIM data)	0
JR-MA-083	0	0	0	Tr	0	Tr low-Cr diopside (2 gr)	0	0	0	Tr	0	0	Tr	Tr (~50 gr; see KIM data)	0
JR-MA-084	0	0	0	Tr	0	0	0	0	0	Tr	0	0	Tr	2 (~500 gr; see KIM data)	0
JR-MA-085	0	0	0	0	0	Tr low-Cr diopside (3 gr)	0	0	0	0	0	0	Tr	0	0
JR-MA-086	0	0	0	0	0	0	0	0	0	0	0	0	70	Tr (3 gr; see KIM data)	0
JR-MA-087	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	0	0	0
JR-MA-088	0	0	Tr (8 gr)	0	1 blue	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	60	Tr (9 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-089	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-090	Tr (1 gr)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-091	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	Tr	Tr (3 gr; see KIM data)	0
JR-MA-092	0	0	Tr (2 gr)	Tr	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	20	0	0
JR-MA-093	0	0	0	0	0	0	0	0	0	0	0	0	Tr	0	0
JR-MA-094	0	0	0	0	0	0	0	0	0	Tr	0	0	15	Tr (~40 gr; see KIM data)	0
JR-MA-095	0	0	0	Tr	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	Tr	Tr (27 gr; see KIM data)	0
JR-MA-096	0	0	0	0	0	0	0	0	0	0	0	70	0	0	0
JR-MA-097	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0
JR-MA-098	0	0	0	0	0	Tr low-Cr diopside (4 gr)	0	0	0	0	0	1	15	Tr (2 gr; see KIM data)	0
JR-MA-099	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-100	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	0	0	0
JR-MA-101	0	0	0	0	0	0	0	0	0	0	0	0	80	Tr (13 gr; see KIM data)	0
JR-MA-102	0	0	0	0	0	0	0	0	0	0	0	0	Tr	Tr (4 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related Minerals 0.25-0.5 mm				Mg/Mn/Al/Cr Minerals 0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-103	Tr (3 gr)	0	Tr (~15 gr)	0	0	0	0	0	Tr	0	0	0	5	Tr (~120 gr; see KIM data)	0
JR-MA-104	0	0	0	0	0	0	0	0	0	0	0	0	30	Tr (5 gr; see KIM data)	0
JR-MA-105	0	0	0	0	0	0	0	0	0	0	Tr	0	10	Tr (2 gr; see KIM data)	0
JR-MA-106	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	20	0	0
JR-MA-107	0	0	0	0	0	0	0	0	0	0	0	Tr	10	Tr (7 gr; see KIM data)	0
JR-MA-108	0	0	0	0	0	0	0	0	0	0	0	0	50	0	0
JR-MA-109	0	0	0	0	0	Tr low-Cr diopside (7 gr)	0	0	0	Tr	Tr	0	2	Tr (~80 gr; see KIM data)	0
JR-MA-110	0	0	0	0	0	Tr low-Cr diopside (4 gr)	0	0	0	Tr	0	0	5	Tr (3 gr; see KIM data)	0
JR-MA-111	0	0	0	Tr	0	Tr low-Cr diopside (3 gr)	0	0	0	Tr	0	0	5	Tr (2 gr; see KIM data)	0
JR-MA-112	0	0	Tr (1 gr)	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	10	Tr (7 gr; see KIM data)	0
JR-MA-113	0	0	0	0	0	0	0	0	0	Tr	0	Tr	5	Tr (1 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-114	0	0	0	5	0	0	0	0	0	Tr	Tr	0	5	Tr (2 gr; see KIM data)	0
JR-MA-115	0	0	Tr (1 gr)	0	0	Tr low-Cr diopside (1 gr)	0	0	Tr	Tr	Tr	0	Tr	Tr (2 gr; see KIM data)	0
JR-MA-116	0	0	0	Tr	0	0	0	0	0	0	0	0	Tr	Tr (3 gr; see KIM data)	0
JR-MA-117	0	0	Tr (1 gr)	Tr	0	0	0	0	0	0	0	0	5	0	0
JR-MA-118	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0
JR-MA-119	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
JR-MA-120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-121	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
JR-MA-122	0	0	Tr (5 gr)	Tr	0	Tr low-Cr diopside (2 gr)	0	0	0	0	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-123	Tr (1 gr)	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	Tr	0	0
JR-MA-124	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	5	0	0
JR-MA-125	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-126	0	0	0	0	0	0	0	0	0	0	0	0	0	Tr (1 gr; see KIM data)	0
JR-MA-127	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-128	Tr (1 gr)	0	Tr (3 gr)	0	0	Tr Cr-grossular (1 gr) Tr low-Cr diopside (8 gr)	0	0	0	0	0	0	Tr	Tr (~50 gr; see KIM data)	0
JR-MA-129	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-130	0	0	0	0	1 pale blue	Tr low-Cr diopside (6 gr)	0	Tr	Tr	Tr	0	0	5	Tr (~50 gr; see KIM data)	0
JR-MA-131	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-132	0	0	0	0	0	0	0	0	0	0	0	0	Tr	0	0
JR-MA-133	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	0	0	0	5	Tr (5 gr; see KIM data)	0
JR-MA-134	0	0	0	0	0	Tr low-Cr diopside (3 gr)	0	0	0	Tr	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-135	0	0	0	0	0	0	0	0	0	Tr	0	0	40	Tr (2 gr; see KIM data)	0
JR-MA-136	Tr (1 gr)	0	8 (~75 gr)	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-137	0	0	0	0	0	0	0	0	0	0	0	0	Tr	0	0
JR-MA-138	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
JR-MA-139	0	0	0	0	0	0	0	0	0	Tr	0	0	Tr	0	0
JR-MA-140	0	0	0	0	0	Tr Cr-grossular (1 gr) Tr low-Cr diopside (1 gr)	0	0	0	Tr	0	0	2	Tr (25 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-141	Tr (1 gr)	0	Tr (5 gr)	0.5	2 pale pink, pale blue	Tr Cr-grossular (1 gr) Tr low-Cr diopside (3 gr)	0	0	0.5	1	0	0	Tr	Tr (~200 gr; see KIM data)	0
JR-MA-142	0	0	0	0	0	0	0	0	0	0	0	0	5	Tr (18 gr; see KIM data)	0
JR-MA-143	0	0	0	0	0	Tr corundum (1 gr)	0	0	0	0	Tr	0	70	Tr (10 gr; see KIM data)	0
JR-MA-144	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	Tr	1 (40 gr; see KIM data)	0
JR-MA-145	0	0	Tr (5 gr)	0	0	0	0	Tr	Tr	0	0	0	5	Tr (8 gr; see KIM data)	0
JR-MA-146	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0
JR-MA-147	0	0	0	0	0	Tr low-Cr diopside (4 gr)	0	0	0	0	0	0	80	0	0
JR-MA-148	0	0	0	0	0	0	0	0	0	0	0	0	80	Tr (34 gr; see KIM data)	0
JR-MA-149	0	0	0	0	0	Tr low-Cr diopside (3 gr)	0	0	0	Tr	0	0	Tr	Tr (14 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-150	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	60	Tr (5 gr; see KIM data)	0
JR-MA-151	0	0	0	0	0	0	0	0	0	Tr	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-152	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	Tr	3	0	0	5	Tr (57 gr; see KIM data)	0
JR-MA-153	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	0	Tr	0	Tr	Tr (11 gr; see KIM data)	0
JR-MA-154	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	Tr	0	0	0	60	0	0
JR-MA-155	0	0	0	0	0	0	0	0	0	0	0	0	40	0	0
JR-MA-156	0	0	0	0	0	0	0	0	0	1	0	0	15	Tr (1 gr; see KIM data)	0
JR-MA-157	Tr (5 gr)	0	Tr (5 gr)	0	0	Tr low-Cr diopside (36 gr)	0	0	0	0	Tr	0	50	Tr (4 gr; see KIM data)	0
JR-MA-158	0	0	0	0	0	0	0	0	0	0	0	0	70	0	0
JR-MA-159	0	0	0.4 (29 gr)	0	0	Tr low-Cr diopside (2 gr)	0	0	0	0	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-160	0	0	Tr (~15 gr)	0	0	Tr low-Cr diopside (10 gr)	0	0	0	Tr	0	0	5	Tr (6 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related				Mg/Mn/Al/Cr Minerals										
	Minerals 0.25-0.5 mm				0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-161	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	Tr	0	0	Tr	Tr (1 gr; see KIM data)	0
JR-MA-162	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	70	0	0
JR-MA-163	Tr (2 gr)	0	0	0	0	0	0	0	0	0	0	0	80	0	0
JR-MA-164	0	0	0	1	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	5	0	0
JR-MA-165	0	0	0	1	0	0	0	0	0	0	0	0	Tr	Tr (11 gr; see KIM data)	0
JR-MA-166	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	0	0	0	40	0	0
JR-MA-167	0	0	0	0	0	0	0	0	0	0	0	0	25	Tr (6 gr; see KIM data)	0
JR-MA-168	0	0	0	0	0	0	0	0	0	0	0	0	60	Tr (11 gr; see KIM data)	0
JR-MA-169	0	0	0	0	0	Tr low-Cr diopside (1 gr)	0	0	0	Tr	Tr	0	70	Tr (1 gr; see KIM data)	0
JR-MA-170	0	0	0	0	0	0	0	0	0	0	0	0	80	0	0
JR-MA-171	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0
JR-MA-172	0	0	0	0	0	0	0	0	0	Tr	0	0	2	0	0
JR-MA-173	0	0	0	0	0	0	0	0	0	0	0	0	45	Tr (14 gr; see KIM data)	0

Appendix I. MMSIM picking results

Sample Number	Sulphide/Arsenide + Related Minerals 0.25-0.5 mm				Mg/Mn/Al/Cr Minerals 0.25-0.5 mm										
	>1.0 amp			<1.0 amp	>1 amp					>0.8 amp	<0.8 amp				>1.0 amp
	% Cpy	Misc. Prime MMSIMs	% Py	% Gth	# Grains + Colour Spinel	Misc. Prime MMSIMs	% Red Rutile	% Ky	% Sil	% St	% Sps	% Fay	% Opx	% Cr	Prime Carbonatite Minerals
JR-MA-174	0	0	Tr (10 gr)	0	0	Tr low-Cr diopside (5 gr)	0	0	0	Tr	Tr	0	2	Tr (~120 gr; see KIM data)	0
JR-MA-175	0	0	Tr (15 gr)	0	0	Tr low-Cr diopside (2 gr)	0	0	0	0	Tr	0	70	Tr (12 gr; see KIM data)	0
JR-SG-001	0	0	0	0	0	Tr low-Cr diopside (8 gr)	0	0	0	0	0	0	0	Tr (6 gr; see KIM data)	0
JR-SG-002	0	0	0	0	0	Tr low-Cr diopside (3 gr)	0	0	0	Tr	0	Tr	25	Tr (~75 gr; see KIM data)	0
JR-SG-003	0	0	0	0	0	Tr low-Cr diopside (3 gr)	0	0	0	Tr	0	0	10	Tr (~50 gr; see KIM data)	0
JR-SG-004	0	0	0	0	0	0	0	0	0	Tr	0	0	15	Tr (16 gr; see KIM data)	0
JR-SG-005	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	0.5	Tr	0	2	Tr (4 gr; see KIM data)	0
JR-SG-006	0	0	0	0	0	0	0	0	0	0	Tr	25	Tr	0	0
JR-TM-001	0	0	0	0	0	Tr low-Cr diopside (2 gr)	0	0	0	Tr	0	5	35	Tr (14 gr; see KIM data)	0
JR-TM-002	0	0	0	0	0	Tr low-Cr diopside (4 gr)	0	0	0	0	0	2	30	Tr (40 gr; see KIM data)	0

Appendix J

Pebble Lithology Counts

Summary List of Abbreviations

FII	Felsic intrusive
MI	Mafic intrusive
GN	Gneiss
FM	Felsic metavolcanic
MM	Mafic metavolcanic
SED	Sedimentary
HSG	Huronian Supergroup

Appendix J. Pebble Lithology Counts

Sample	Rock Type	% SED	% FII	% MI	% FM	% MM	% GN	% OTHER	% TOTAL INTRUSIVES	% TOTAL VOLCANICS	% TOTAL SEDIMENTARY
02-JR-MA-023	FII	58	6	30	0	0	0	6	36	0	58
02-JR-MA-026	FII	49	2	49	0	0	0	0	51	0	49
02-JR-MA-027	FII	55	10	35	0	0	0	0	45	0	55
02-JR-MA-073	FII	9	44	43	2	0	2	0	87	2	9
02-JR-MA-133	FII	20	80	0	0	0	0	0	80	0	20
02-JR-MA-007	HSG	65	0	33	0	0	0	2	33	0	65
02-JR-MA-025	HSG	56	4	38	2	0	0	0	42	2	56
02-JR-MA-029	HSG	31	44	17	2	6	0	0	60	8	31
02-JR-MA-030	HSG	76	0	22	0	0	2	0	22	0	76
02-JR-MA-032	HSG	48	6	46	0	0	0	0	52	0	48
02-JR-MA-037	HSG	96	0	4	0	0	0	0	4	0	96
02-JR-MA-038	HSG	79	0	21	0	0	0	0	21	0	79
02-JR-MA-039	HSG	36	0	0	0	64	0	0	0	64	36
02-JR-MA-050	HSG	35	16	33	16	0	0	0	49	16	35
02-JR-MA-057	HSG	81	2	13	0	0	0	4	15	0	81
02-JR-MA-058	HSG	38	12	47	3	0	0	0	59	3	38
02-JR-MA-061	HSG	37	22	26	15	0	0	0	48	15	37
02-JR-MA-062	HSG	7	93	0	0	0	0	0	93	0	7
02-JR-MA-063	HSG	37	5	28	30	0	0	0	33	30	37
02-JR-MA-065	HSG	39	61	0	0	0	0	0	61	0	39
02-JR-MA-077	HSG	34	14	40	0	0	2	10	54	0	34
02-JR-MA-080	HSG	63	2	23	8	0	0	4	25	8	63
02-JR-MA-083	HSG	25	46	13	0	0	0	15	60	0	25
02-JR-MA-084	HSG	57	26	9	9	0	0	0	35	9	57
02-JR-MA-086	HSG	60	0	0	40	0	0	0	0	40	60
02-JR-MA-091	HSG	98	0	0	0	0	2	0	0	0	98
02-JR-MA-092	HSG	95	2	0	0	0	0	4	2	0	95
02-JR-MA-096	HSG	20	76	0	0	0	0	4	76	0	20
02-JR-MA-101	HSG	54	37	7	2	0	0	0	43	2	54
02-JR-MA-103	HSG	58	0	25	15	0	0	2	25	15	58
02-JR-MA-104	HSG	9	0	89	0	0	0	2	89	0	9
02-JR-MA-112	HSG	4	71	18	6	0	0	0	90	6	4
02-JR-MA-113	HSG	15	35	15	35	0	0	0	50	35	15
02-JR-MA-115	HSG	18	69	13	0	0	0	0	82	0	18
02-JR-MA-116	HSG	4	0	8	85	0	0	4	8	85	4
02-JR-MA-141	HSG	69	0	4	25	0	2	0	4	25	69
02-JR-MA-142	HSG	23	13	62	2	0	0	0	75	2	23
02-JR-MA-148	HSG	26	0	65	9	0	0	0	65	9	26

Appendix J. Pebble Lithology Counts

Sample	Rock Type	% SED	% FII	% MI	% FM	% MM	% GN	% OTHER	% TOTAL INTRUSIVES	% TOTAL VOLCANICS	% TOTAL SEDIMENTARY
02-JR-MA-157	HSG	29	0	71	0	0	0	0	71	0	29
02-JR-MA-165	HSG	24	64	12	0	0	0	0	76	0	24
02-JR-MA-167	HSG	35	46	6	6	0	0	6	52	6	35
02-JR-MA-168	HSG	28	34	0	38	0	0	0	34	38	28
02-JR-MA-171	HSG	0	100	0	0	0	0	0	100	0	0
02-JR-MA-173	HSG	38	14	48	0	0	0	0	62	0	38
02-JR-MA-174	HSG	27	20	52	0	0	0	2	71	0	27
02-JR-MA-175	HSG	25	37	8	0	0	0	31	44	0	25
02-JR-SG-001	HSG	50	5	27	14	0	5	0	32	14	50
02-JR-MA-016	MI	46	0	50	2	0	0	2	50	2	46
02-JR-MA-017	MI	32	0	56	12	0	0	0	56	12	32
02-JR-MA-022	MI	39	0	52	9	0	0	0	52	9	39
02-JR-MA-076	MI	28	36	32	0	0	0	4	68	0	28
02-JR-MA-088	MI	30	15	54	0	0	0	0	70	0	30
02-JR-MA-094	MI	86	0	4	10	0	0	0	4	10	86
02-JR-MA-095	MI	69	0	0	31	0	0	0	0	31	69
02-JR-MA-098	MI	16	21	62	0	0	0	2	83	0	16
02-JR-MA-105	MI	39	0	0	61	0	0	0	0	61	39
02-JR-MA-109	MI	29	29	2	41	0	0	0	31	41	29
02-JR-MA-111	MI	10	0	0	88	0	0	2	0	88	10
02-JR-MA-153	MI	0	75	25	0	0	0	0	100	0	0

Appendix K

Summary of Normalized Kimberlite Indicator Mineral Results

Summary List of Abbreviations

KIM	Kimberlitic
diop	Diopside
GP	Pyrope Garnet
GO	Eclogitic Garnet
DC	Chrome Diopside
IM	Ilmenite
CR	Chromite
Cr	Chromium
FO	Forsteritic Olivine
(p)	Amount of grains picked from the sample
(e)	Amount of grains estimated to be in sample
tot	total
c	confirmed

Total KIM chromites include those that plot within the overlap field and are considered to possibly be of kimberlitic affinity

Sample Calculation

* *Picked Estimate Normalization*

Example

For sample JR-MA-077, 200 chromites were estimated to be present, but only 21 were picked and sent for microprobe analysis. Microprobe analysis confirmed that 20 were kimberlitic.
The normalization calculation is

$$\#\text{ of normalized grains} = \frac{(\text{estimated \# of grains})}{(\text{\# of picked grains})} \times (\text{\# of confirmed KIMs})$$

$$= \frac{200}{21} \times 20$$

$$= 190\text{ grains}$$

Appendix K. Normalized KIM results

Sample Number	Selected PseudoKIMs			KIM Count																				Total KIMs	Total KIMs probed					picked estimate normalization
	1.0-2.0 mm	0.5-1.0 mm	0.25-0.5 mm	1.0 to 2.0 mm						0.5 to 1.0 mm						0.25 to 0.5 mm														
	Low-Cr diop.	Low-Cr diop.	Low-Cr diop.	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM	CR	FO	GP	GO	DC	IM (p)	IM (e)	CR (p)	CR (e)	FO		IM	CR	CR-kim field	CR-overlap	tot (C) KIM IM	tot (C) KIM CR
JR-MA-007	0	0	0	0	0	0	0	0	0	0	1	0	21	1	0	2	1	0	34	50	21	0	0	97	44				65	
JR-MA-037	0	2	1	0	0	0	0	0	0	1	0	0	0	0	0	5	0	0	1	0	53	75	0	82		52	2	50		74
JR-MA-050	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	40	120	0	123		40	1	39		120
JR-MA-065	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	21	60	0	61		21	2	19		60
JR-MA-076	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	50	0	50		22		22		37
JR-MA-077	0	0	5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	21	200	0	203		20		20		190
JR-MA-078	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	21	50	0	51		20	1	19		48
JR-MA-080	0	0	6	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	20	60	0	61		17	1	16		51
JR-MA-083	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	20	50	0	51		18		18		45
JR-MA-084	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	30	500	0	501		27	1	26		450
JR-MA-094	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	2	0	0	7	0	28	40	0	52		27	1	26		39
JR-MA-103	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	25	120	0	124		29		29		139
JR-MA-109	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30	80	0	80		28		28		75
JR-MA-128	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	50	0	50		13	1	12		33
JR-MA-130	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	30	50	0	51		25		25		42
JR-MA-141	0	0	3	0	0	0	0	0	0	0	0	0	0	5	0	1	0	0	0	0	30	200	0	206		30		30		200
JR-MA-144	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20	40	0	40		21	5	16		42
JR-MA-174	0	0	5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	60	120	0	121		59		59		118
JR-SG-002	0	0	3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	1	0	30	75	0	79		28	3	25		70
JR-SG-003	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	31	50	0	50		27		27		44
JR-TM-002	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	20	40	0	41		15		15		30

Metric Conversion Table

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
			LENGTH		
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
			AREA		
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
			VOLUME		
1 cm^3	0.061 023	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.307 951	cubic yards	1 cubic yard	0.764 554 86	m^3
			CAPACITY		
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
			MASS		
1 g	0.035 273 962	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 747	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 622 6	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311 3	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 90**	t
			CONCENTRATION		
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	31.103 477	grams per ton (short)
1 gram per ton (short)	0.032 151	ounces (troy) per ton (short)
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.

MAPS

NOT FILMED

CARTES

NON FILMÉ

Micromedia
ProQuest

20 Victoria Street
Toronto, Ontario M5C 2N8
Tel.: (416) 362-5211
Toll Free: 1-800-387-2689
Fax: (416) 362-6161
Email: info@micromedia.on.ca